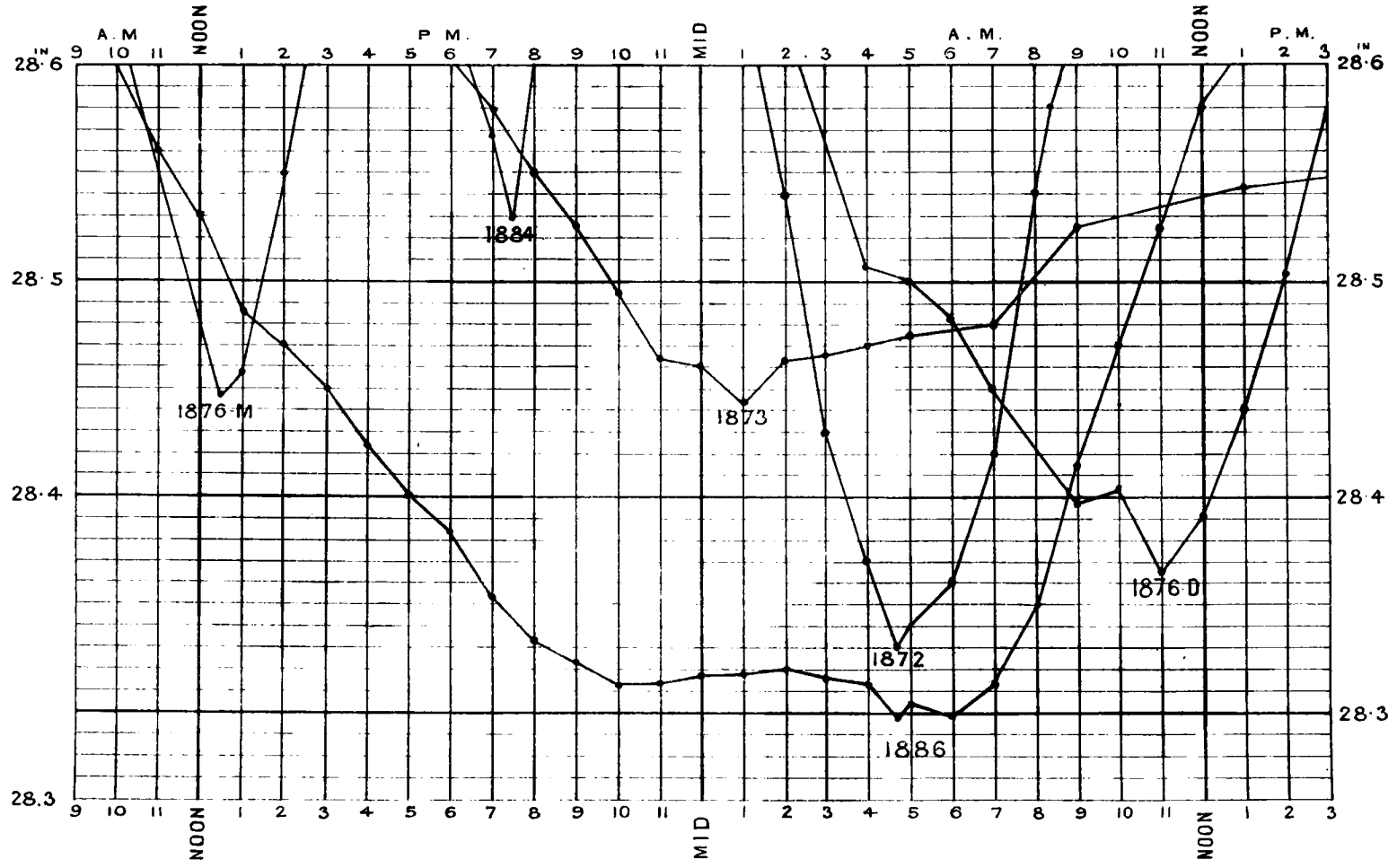
Low Sea-Level Pressures at Camden Square, London 1858-1886.



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THUNDERSTORMS IN RUSSIA.

PROFESSOR KLOSSOVSKY, of Odessa, has just issued an abstract in French* of the careful and elaborate paper which he published in Russian in 1884. Unfortunately we can only read Russian at a snail's pace, and the 116 pages of Professor Klossovsky's original work would *per se* have been beyond our power; but as he has been kind enough to send us both the full Russian memoir, and the French abstract, the two are mutually helpful, and enable us to lay before our readers a short account of one of the most careful studies of the causes and of the geographical distribution of thunderstorms which we remember having seen.

In the year 1871, the Imperial Geographical Society of St. Petersburg issued blank forms, giving instructions for observations of thunderstorms which would not require the use of instruments, but which should supply the following details:—

Government (*i.e.*, the equivalent of "country.")	
District (*i.e.*, the equivalent of county.)	
Place of Observation.	
Thunderstorm date, month, year.	
Time of	Commencement.
	Ending.
Cardinal Points	Whence it came,
	Whither it went.
Intensity	Lightning.
	Thunder.
Amount & Duration.	Rain.
	Hail.
Direction & Velocity.	Wind near the earth's surface,
	Movement of clouds.
Signature.	

From the Russian memoir, it appears that during the 10 years 1873 to 1882, nearly six thousand such reports were received from a

* Les Orages en Russie. A. Klossovsky, Professeur à l Université d'Odessa. 8vo. 32 pages. Odessa, Imprimerie d'Odessky Westnik, 1886.

total of 176 stations, but this was not sufficient for so vast an empire as that of all the Russias (for it must be remembered that this memoir embraces Asiatic as well as European Russia). Prof. Klossovsky therefore searched the *Annales de l'Observatoire physique de St. Petersbourg* for 17 years, and also the records for five years of the claims upon a Russian Hailstorm Insurance Society.

The work is divided into three sections, of each of which we will give a brief epitome.

The author has determined (and gives in the Russian edition) the mean monthly and annual number of storms at 145 stations. It is rather a pity that he did not lay the annual values down upon a map, as it would have saved others the trouble of doing it perhaps several times over. However, probably the following table, which we have worked out from Prof. Klossovsky's data, will give a sufficient general idea :—

District.	No. of Stations.	Mean No. of Days with Storm.	Highest.*	
Northern Russia.....	11	8·0	Bielosiersk	11·3
Baltic Provinces.....	21	9·4	Dorpat	13·4
Western Provinces.....	12	15·3	Stary-Bychow.....	26·0
Central Provinces	12	15·9	Tambof.....	26·2
Southern Russia and Crimea	11	15·4	Kichineff	32·7
Uralia	6	20·5	Blagodat	26·1
Caucasia	10	26·6	Tiflis	40·8
Shores of the Caspian	5	7·1	Astrabad	12·0
Siberia.....	17	14·2	Kaltuk (on Lake Baikal) ...	24·6
Central Asia	4	8·4	Irgis	11·0

The district where storms are most frequent is the Caucasus, where there are generally about 30 in a year ; at Tiflis there are 41. On the contrary, they are rare on the shore of the Caspian, in Central Asia, Northern Siberia, at Kola in Lapland, and at Archangel. The author examines the yearly frequency of storms, and finds that of the ten years 1870-79, they were most numerous in 1872, and rarest in 1874 ; he mentions incidentally that 1874 was a year of minimum sunspots, but if so the max. in 1872 is too uncomfortably close to the minimum to harmonize with an eleven-year sunspot period.

The preponderances of storms in the twelve hours between noon and midnight (81 per cent.), over those between midnight and noon (19 per cent.) is very marked.

The few thunderstorms which occur in Northern Russia occur almost solely in the summer, 86·2 per cent. of the total number are in the three summer months, and a nearly equally large proportion occur in those months in the Ural mountains, and throughout Siberia ; but less than three-quarters of the total storms occur in the

* We do not give the lowest, because in several cases it seems evident that the observers have not been careful—*e.g.*, Novaia Ladoga, which reports 3·8, has two stations near to it reporting 9·6 and 11·6 respectively ; and again, Weissenstein, with 6·8, has for its nearest neighbours Pernau, with 12·0, and Dorpat with 13·4. It is therefore probable that all the means are below rather than above the truth.

summer in Central, Eastern, and Southern Russia, and in the Caucasus. In the last-named district there are more autumn and winter storms than in any other part of Russia. The author seems to have drawn (but not printed) a map of storm frequency, and to have compared it with the curves in Dr. Wild's great work on the temperature of Russia,* but though there was some correspondence, it was not close. Prof. Klossovsky then computed from the *Annales* the mean annual and seasonal rainfall for 48 stations, the annual values did not help him much, but the summer ones did. We must, however, express a little hesitation as to whether this relation should not be regarded rather as the effect than the cause of the distribution of thunderstorms. We quite agree with the author that the essentials for a heavy thunderstorm are a high temperature and moisture; but a thunderstorm is usually accompanied by rain and hail, and hence our difficulty as to which is cause and which effect.

The author proceeds to study very carefully the relations of thunderstorms and of storm tracks to cyclonic systems. He devotes nearly 50 pages of the Russian memoir to placing side by side a daily epitome of the weather of Europe according to Hoffmeyer's charts, and the details obtained from his own reporters respecting the occurrence of storms.

He gives a table which we may reduce into two lines, and which shows that thunderstorms do not prevail with low barometer readings :—

Sea Level Pressure...	28·9 to 29·1	29·1 to 29·3	29·3 to 29·5	29·5 to 29·7	29·7 to 29·9	29·9 to 30·1	30·1 to 30·3
Per centage of thunderstorms ...	0·1	0·3	5·8	37·5	48·3	7·9	0·1

He then remarks that his researches have convinced him that thunderstorms in Russia are small and unimportant eddies or whirlwinds due to the segmentation of the periphery of a cyclone, and he proceeds to discuss the 4,519 storm reports, in order to ascertain in which quadrant of a cyclone they are most frequent, and finds a great preponderance in the quadrant between S. and E.

Prof. Klossovsky then discusses the reports which he has received respecting hailstorms, and finds that they are most prevalent in the same portion of cyclones, and he concludes by remarking that this S.E. quadrant has already been pointed out as that in which tornadoes are generally formed, and that therefore there may fairly be assumed to be some points of analogy between an ordinary Russian thunderstorm and the furious tornadoes of some other countries.

* Die Temperaturverhältnisse des Russischen Reiches. 4to.

MR. AITKEN ON DEW.

[IT is not often that we allot any of the limited space at our command to reprints. The following is, however, so essentially appropriate to our pages, and so many of our readers are competent to discuss it, that we think its reproduction a duty. The following is the abridgment published in *Nature*. The paper was read before the Royal Society of Edinburgh on December 21st, 1885.—ED.]

The first point referred to in this paper is the source of the vapour that condenses to form dew. A short historical sketch is given of the successive theories from time to time advanced on this point, showing how in early times dew was supposed to descend from the heavens, and then afterwards it was suggested that it rose from the earth, while Dr. Wells, who has justly been considered the great master of this subject, thought it came neither from above nor from below, but was condensed out of the air near the surface of the earth. He combated Gersten's idea that it rose from the earth, and showed that all the phenomena observed by Gersten and others which were advanced to support this theory could be equally well explained according to the theory that it was simply formed from the vapour present at the time in the air, and which had risen from the ground during the day, and concluded that if any did rise from the ground during night, the quantity must be small, but, with great caution, he adds that "he was not acquainted with any means of determining the proportion of this part to the whole."

A few observations of the temperature of the ground near the surface and of the air over it, first raised doubts as to the correctness of the now generally received opinion that dew is formed of vapour existing at the time in the air. These observations, made at night, showed the ground at a short distance below the surface to be always hotter than the air over it; and it was thought that so long as this excess is sufficient to keep the temperature of the surface of the ground above the dew-point of the air, it will, if moist, give off vapour; and it will be this rising vapour that will condense on the grass and form dew, and not the vapour that was previously present in the air.

The first question to be determined was whether vapour does, or does not, rise from the ground on dewy nights. One method tried of testing this point was by placing over the grass, in an inverted position, shallow trays made of thin metal and painted. These trays were put over the ground to be tested after sunset and examined at night, and also next morning. It was expected that, if vapour was rising from the ground during dewy nights, it would be trapped inside the trays. The result in all the experiments was that the inside was dewed every night, and the grass inside was wetter than that outside. On some nights there was no dew outside the trays, and on all nights the inside deposit was heavier than the outside one.

An analysis of the action of these trays is given, and it is concluded that they act very much the same as if the air was quite still. Under these conditions vapour will rise from the ground so long as the vapour-tension on the surface of the ground is higher than that at the top of the grass, and much of this rising vapour is, under ordinary conditions, carried away by the passing air, and mixed with a large amount of drier air, whereas the vapour rising under the trays is not so diluted; and hence, though only cooled to the same amount as the air outside, it yields a heavier deposit of dew.

Another method of testing this point was employed, which consisted in weighing a small area of the exposed surface of the ground, as it was evident that if the soil gave off vapour during a dewy night it must lose weight. A small turf about 6 inches (152 mm.) square, was cut out of the lawn and placed in a small shallow pan of about the same size. The pan with its turf, after being carefully weighed, was put out on the lawn in the place where the turf had been cut. It was exposed for some hours while dew was forming, and on these occasions it was always found to lose weight. It was thus evident that vapour was rising from the ground while dew was forming, and therefore the dew found on the grass was formed of part of the rising vapour, trapped or held back by coming into contact with the cold blades of grass.

The difference between these experiments in which the exposed bodies *lose* weight, and the well-known ones in which bodies are exposed to radiation, and the amount of dew formed is estimated by the *increase* in their weight, is pointed out. In the former case the bodies are in good heat-communication with the ground, whereas in the latter, little or no heat is received by conduction from the earth.

Another method employed for determining whether the conditions found in nature were favourable for dew rising from the ground on dewy nights, was by observations of the temperatures indicated by two thermometers, one placed on the surface of the grass, and the other under the surface, amongst the stems, but on the top of the soil. The difference in the readings of these two thermometers on dewy nights was found to be very considerable. From 10° to 18° F. was frequently observed. A minimum thermometer placed on, and another under, the grass, showed that during the whole night a considerable difference was always maintained. As a result of this difference of temperature, it is evident that vapour will rise from the hotter soil underneath, into the colder air above, and some of it will be trapped by coming into contact with the cold grass.

While the experiments were being conducted on grass land parallel observations were made on bare soil. Over soil the inverted traps collected more dew inside them than those over grass. A small area of soil was spread over a shallow pan, and after being weighed was exposed at the place where the soil had been taken out, to see if bare soil as well as grass lost weight during dewy nights. The result was that on all nights on which the tests were made the soil lost weight, and lost very nearly the same amount as the grass land.

Another method employed of testing whether vapour is rising from bare soil, or is being condensed upon it, consisted in placing on the soil, and in good contact with it, small pieces of black mirror, or any substance having a surface that shows dewing easily. In this way a small area of the surface of the earth is converted into a hygroscope, and these test-surfaces tell us whether the ground is cooled to the dew-point or not. So long as they remain clear and undewed, the surface of the soil is hotter than the dew-point, and vapour is being given off, while if they get dewed, the soil will also be condensing vapour. On all nights observed, these test-surfaces kept clear, and showed the soil to be always giving off vapour.

All these different methods of testing point to the conclusion that during dewy nights, in this climate, vapour is constantly being given off from grass land, and almost always from bare soil ; that the tide of vapour almost always sets outwards from the earth, and but rarely ebbs, save after being condensed to cloud and rain, or on those rarer occasions on which, after the earth has got

greatly cooled, a warm moist air blows over it. The results of some of the experiments are given, showing, from weighings, the amount of vapour lost by the soil at night, and also the heat lost by the surface soil.

It seems probable that when the radiation is strong, that soil, especially if it is loose and not in good heat-communication with the ground, will get cooled below the dew-point, and have vapour condensed upon it. On some occasions the soil certainly got wetter on the surface, but the question still remains, Whence the vapour? Came it from the air, or from the soil underneath? The latter seems the more probable source: the vapour rising from the hot soil underneath will be trapped by the cold surface soil, in the same way as it is trapped by grass over grass land. During frost, opportunities are afforded of studying this point in a satisfactory manner, as the trapped vapour keeps its place where it is condensed. On these occasions the under sides of the clods, at the surface of the soil, are found to be thickly covered with hoar-frost, while there is little on their upper or exposed surfaces, showing that the vapour condensed on the surface soil has come from below.

The next division of the subject is on dew on roads. It is generally said that dew forms copiously on grass, while none is deposited on roads, because grass is a good radiator and cools quicker, and cools more, than the surface of a road. It is shown that the above statement is wrong, and that dew really does form abundantly on roads, and that the reason it has not been observed is that it has not been sought for at the correct place. We are not entitled to expect to find dew on the surface of roads as on the surface of grass, because stones are good conductors of heat, and, the vapour-tension being higher underneath than above the stones, the result is, the rising vapour gets condensed on the under sides of the stones. If a road is examined on a dewy night, and the gravel turned up, the under sides of the stones are found to be dripping wet.

Another reason why no dew forms on the surface of roads is that the stones, being fair conductors, and in heat-communication with the ground, the temperature of the surface of the road is, from observations taken on several occasions, higher than that of the surface of the grass alongside. The air in contact with the stones is, therefore, not cooled so much as that in contact with the grass.

For studying the formation of dew on roads, slates were found to be useful. One slate was placed over a gravelly part of the road, and another over a hard dry part. Examined on dewy nights the under sides of these slates were always found to be dripping wet, while their upper surfaces, and the ground all round, were quite dry.

The importance of the heat communicated from the ground is illustrated by a simple experiment with two slates or two iron weights, one of them being placed on the ground, either on grass or on bare soil, and the other elevated a few inches above the surface. The one resting on the ground, and in heat-communication with it, is found always to keep dry on dewy nights, whereas the elevated one gets dewed all over.

The effect of wind in preventing the formation of dew is referred to. It is shown that, in addition to the other ways already known, wind hinders the formation of dew by preventing an accumulation of moist air near the surface of the ground.

An examination of the different forms of vegetation was made on dewy nights. It was soon evident that something else than radiation and condensa-

tion was at work to produce the varied appearances then seen on plants. Some kinds of plants were found to be wet, while others of a different kind, and growing close to them, were dry, and even on the same plant some branches were wet, whilst others were dry. The examination of the leaf of a broccoli plant showed better than any other that the wetting was not what we might expect if it were dew. The surface of the leaf was not wet all over, and the amount of deposit on any part had no relation to its exposure to radiation, or access to moist air; but the moisture was collected in little drops, placed at short distances apart, along the very edge of the leaf. Closer examination showed that the position of these drops had a close relation to the structure of the leaf; they were all placed at the points where the veins in the leaf came to the outer edge, at once suggesting that these veins were the channels through which the liquid had been expelled. An examination of grass revealed a similar condition of matters: the moisture was not equally distributed over the blade, but was in drops attached to the tips of some of the blades. These drops, seen on vegetation on dewy nights, are therefore not dew at all, but are an effect of the vitality of the plant.

It is pointed out that the excretion of drops of liquid by plants is no new discovery, as it has been long well known, and the experiments of Dr. Moll on this subject are referred to; but what seems strange is that the relation of it to dew does not seem to have been recognised.

Some experiments were made on this subject in its relation to dew. Leaves of plants that had been seen to be wet on dewy nights were experimented on. They were connected by means of an india-rubber tube with a head of water of about 1 metre, and the leaf surrounded with saturated air. All were found to exude a watery liquid after being subjected to pressure for some hours, and a broccoli leaf got studded all along its edge with drops, and presented exactly the same appearance it did on dewy nights. A stem of grass was also found to exude at the tips of one or two blades when pressure was applied.

The question as to whether these drops are really exuded by the plant, or are produced in some other way, is considered. The tip of a blade of grass was put under conditions in which it could not extract moisture from the surrounding air, and, as the drop grew as rapidly under these conditions as did those on the unprotected blades, it is concluded that these drops are really exuded by the plant. Grass was found to get "dewed" in air not quite saturated.

On many nights no true dew is formed, and nothing but these exuded drops appears on the grass; and on all nights when vegetation is active, these drops appear before the true dew, and if the radiation is strong enough and the supply of vapour sufficient, true dew makes its appearance, and now the plants get equally wet all over, in the same manner as dead matter. The difference between true dew on grass, and these exuded drops, can be detected at a glance. The drops are always exuded at a point near the tip of the blade, and form a drop of some size, while true dew is distributed all over the blade. The exuded liquid forms a large diamond-like drop, while the dew coats the blade with a pearly lustre.

Towards the end of the paper the radiating powers of different surfaces at night is considered, and after a reference to some early experiments on this subject, the paper proceeds to describe some experiments made with the radiation-thermometer described by the author in a previous paper. When work-

ing with this instrument it is placed in a situation having a clear view of the sky all round, and is fixed at the same height as the ordinary thermometer-screen, which is worked along with it, the difference between the thermometer in the screen and the radiation-thermometer being observed. This difference in clear nights amounts to from 7° to 10°. By means of the radiation-thermometer the radiating powers of different surfaces were observed. Black and white cloths were found to radiate equally well; soil and grass were also almost exactly equal to each other. Lampblack was equal to whitening. Sulphur was about 2/3rds of black paint, and polished tin about 1/7th of black paint. Snow in the shade on a bright day was at midday 7° colder than the air, while a black surface at the same time was only 4° colder. This difference diminished as the sun got lower, and at night both radiated almost equally well.

ROYAL METEOROLOGICAL SOCIETY.

THE annual General Meeting of this Society was held on Wednesday evening, January 20th, at the Institution of Civil Engineers, Mr. R. H. Scott, F.R.S., President, in the chair.

The Secretary read the report of the Council, which stated that the past year had been one of great activity, as the eight Committees which had been appointed had met frequently, and had done much for the advancement of meteorology. The number of Fellows on the roll of the Society is 537.

The President (Mr. R. H. Scott), in his address, said that as he had treated of land climatology in his previous address, he proposed to deal with marine climatology on the present occasion, and to take up the subject at the point where he had left it in his paper, "Remarks on the Present Condition of Marine Meteorology," printed in the Society's "Quarterly Journal" for 1876. He enumerated the various investigations which had been announced as in progress at that date, and specified the several outcomes of these enquiries which had seen the light during the ten years. The "Meteorological Charts for the Ocean District Adjacent to the Cape of Good Hope," published by the Meteorological Office in 1882, was first noticed, and the methods of "weighting" observations of wind, &c., employed in that work were fully explained, as well as the mode of representing barometrical results. The "Charts Showing the Surface Temperature of the Atlantic, Indian, and Pacific Oceans," published in 1884; and those of barometrical pressure, now in the engraver's hands, were next noticed, and it was announced that the Meteorological Council had decided to undertake the issue of Monthly Current Charts for the entire sea surface. The Wind Charts, published by the late Lieut. Brault, of the French Navy, were next described, with an expression of the profound regret with which the intelligence of his premature death in August last had been received by all meteorologists. The Wind Charts and Pressure Tables issued by the Meteorological Institute of the Netherlands were then explained, and also the publications of the Deutsche Seewarte at Hamburgh—"The Atlas of the

Atlantic Ocean," &c. The series of "Monthly Charts for the Atlantic and Pacific Oceans," issued by the Hydrographic Office, Washington, was then described, and the present series of "Pilot Charts," issued by the same office, was explained.

As for projected work in 1886, Mr. Scott stated that the daily maps of Atlantic weather for the year of the circumpolar expeditions were now complete, and were being engraved, a process which must take several months. The German Office had undertaken the preparation of daily weather maps for the same period for the South Atlantic. The Meteorological Office had also taken up the marine meteorology of the Red Sea. The Dutch Institute had announced its intention to publish an atlas for the Indian Ocean.

In conclusion Mr. Scott stated that there still existed a lamentable want of data for the Pacific Ocean, but that, thanks to the energy of the Canadian Government in opening up their new Pacific Railroad, it was to be hoped that every year would bring a greater amount of traffic to British ports on the Pacific coast, and, therefore, a greater number of observations to the Meteorological Office; while from the existing trade to San Francisco a mass of materials was quickly accumulating, for certain routes at least, over the vast area of the Pacific.

The following gentlemen were elected Officers and Council for the ensuing year:—*President.*—William Ellis, F.R.A.S. *Vice-Presidents.*—George Chatterton, M.A., M.Inst.C.E.; Edward Mawley, F.R.H.S.; George Mathews Whipple, B.Sc., F.R.A.S.; George Theodore Williams, M.A., M.D., F.R.C.P. *Treasurer.*—Henry Perigal, F.R.A.S., F.R.M.S. *Trustees*—Hon. Francis Albert Rollo Russell, M.A.; Stephen William Silver, F.R.G.S. *Secretaries.*—George James Symons, F.R.S.; John William Tripe, M.D., M.R.C.P.Ed. *Foreign Secretary.*—Robert Henry Scott, M.A., F.R.S., F.G.S. *Council.*—Edmund Douglas Archibald, M.A.; William Morris Beaufort, F.R.A.S., F.R.G.S.; Arthur Brewin; Frederic William Cory, M.R.C.S.; Henry Storks Eaton, M.A.; Charles Harding; Richard Inwards, F.R.A.S.; Baldwin Latham, M.Inst.C.E., F.G.S.; John Knox Laughton, M.A., F.R.G.S.; William Marcet, M.D., F.R.S., F.C.S.; Cuthbert Edgar Peek, M.A., F.R.A.S., F R.G.S.; Captain Henry Toynbee, F.R.A.S.

RAINFALL AT SMYRNA.

In an early volume of this Magazine* we gave an abstract of the meteorological observations which had been started at the Smyrna Station of the Smyrna and Aidin Railway by Mr. G. Purser, M.I.C.E.

Professor Raulin has been kind enough to prepare, and to forward to us, the following table, which contains the whole of the monthly values for twenty years, 1864-83, together with the mean for each month, and for the year, as well as for the seasons.

* *Meteorological Magazine*, Vol. IV. (1869), page 106.

We may add, that Smyrna is on the west coast of Asia Minor, in Lat. 38° 26′ N., and Lon. 27° 10′ E., and that the station is about 300 yards inland from the head of the gulf.

It will be noticed that the curve of monthly fall is remarkably regular, in fact but for the exceptional rains of March 1868 and March 1869 it would be absolutely so.

Contrary to our usual practice, and contrary to that which we consider safest as a general rule, we have in this table indicated months of no rain by ..., instead of by 0·00 because, the table being perfect, the ... is not needed to indicate, as usual, "No information," and because the rainless months are so frequent that it was desirable to make their occurrence as visible as possible.

Rainfall of Smyrna for 20 Years, 1864–1883, 3 ft. above the surface of the ground, in English inches.

Date.	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873
January	3·29	6·47	1·30	2·43	8·30	3·21	5·79	11·10	3·17	2·41
February	1·43	8·26	1·68	2·94	·32	·74	2·81	1·19	1·46	5·64
March	·54	4·03	1·69	1·06	11·24	12·07	2·29	1·29	·50	2·08
April.....	3·45	1·32	·20	·37	·92	1·78	2·24	·66	4·18	·50
May	1·49	·23	·95	1·27	·83	·19	·07	1·09	3·09	2·38
June	·74	·34	·63	·67	·67	·59	...	·39	·60	·16
July	2·40	·10	·13	...	·27	·04	...	...	...	...
August	·50	...	·06	...	·07	...	·47	...	...	...
September ...	3·00	...	·39	...	·52	·08	3·95	·07	...	2·82
October.....	3·21	1·17	·08	1·44	1·30	1·81	4·45	1·36	...	2·30
November.....	6·20	2·47	3·54	5·26	4·92	3·46	·18	7·04	3·65	2·92
December.....	1·39	·10	3·61	6·48	·84	·80	6·73	4·58	4·76	2·62
Total.....	27·64	24·49	14·26	21·92	30·20	24·77	28·98	28·77	21·41	24·03

Date.	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	Mean average (20 yrs.).
Jan....	·14	4·58	2·88	3·08	6·27	4·28	1·61	6·15	1·27	4·77	4·12
Feb. ..	5·82	9·48	1·45	2·92	2·10	2·69	·30	3·92	1·17	2·59	2·95
March	1·92	5·78	2·53	4·84	3·00	1·61	2·87	1·74	1·04	5·03	3·36
April.	·40	1·36	3·12	1·11	4·97	·35	1·69	·80	3·45	2·67	1·78
May..	·15	...	·42	3·47	·29	2·36	2·69	1·45	·66	2·03	1·26
June..	...	...	1·76	·94	·13	·01	·18	...	·09	1·84	·49
July..	...	...	·54	·11	·40	...	·04	·10	...	·07	·21
Aug...	...	...	...	·36	·63	...	...	...	...	·50	·13
Sept..	...	·02	·15	·08	·61	1·22	1·38	1·32	...	2·45	·90
Oct....	·30	2·87	·94	4·00	...	2·71	·60	5·47	1·02	·47	1·78
Nov...	10·31	4·86	5·75	6·09	·44	4·06	4·09	·15	7·89	1·43	4·24
Dec....	8·99	3·96	8·48	5·98	8·50	1·81	2·49	4·72	4·56	7·05	4·42
Total..	28·03	32·91	28·02	32·98	27·34	21·10	17·94	25·82	21·15	30·90	25·64

Seasonal Mean—Winter, 11·49; Spring, 6·40; Summer, 0·83; Autumn, 6·92; being Régime IV., or that of MONTPELLIER.

THE FROST OF JANUARY, 1886.

THE temperature of January 7th and 8th having been considerably lower at many stations in the neighbourhood of London than on any occasion since the memorable frost of 1881, we have thought it of sufficient interest to supplement the returns published in the Table of Rainfall and Temperature by the following minima in air and on grass.

The degree of cold, though considerable, bears no comparison to the frost before mentioned, and perhaps one of its most remarkable features is the limited area over which the temperature was at all exceptional, the minima over the greater part of the United Kingdoms being of quite a normal character.

The great irregularity of the minima on grass is no doubt due to the varying exposure of the thermometers, some observers placing them on the flat surface of the snow, which at the time covered the ground to the depth of about six inches, while others cleared portions of ground of various sizes for the thermometers to rest upon, some being no more than holes in the snow just large enough to admit the thermometer.

STATION.	AIR MIN.		GRASS MIN.	
	7th. °	8th. °	7th. °	8th. °
Dungeness	27·0	14·0	...	...
Tenterden	22·0	15·0	23·0	15·0
Canterbury	15·0	...	...	...
Weybridge	16·2	16·0	12·1	6·9
Beddington	13·3	9·2	1·7	2·0
Wallington	11·3	12·3	16·1	14·8
Beckenham	21·5	11·8	...	..
Norwood	16·7	19·2	3·0	6·6
Isleworth	19·4	12·6	...	16·6
Kew	16·0	16·5	12·3	10·9
Greenwich	16·5	20·5	16·5	20·0
Old Street	26·1	24·1	...	...
Regent's Park (Roy. Bot. Soc.)	21·5	22·0	22·0	20·0
Camden Square (Glaisher screen)..	24·4	20·8	15·3	8·3
,, ,, (Stevenson screen)	25·0	21·6	...	...
Oxford	18·0	14·0	...	...
Bennington Lodge	14·9	14·7	13·2	12·1
Aspley Guise	18·7	11·8	...	...

SCHOTT'S RAINFALL TABLES, 1872.

WE have just stumbled on an error in these tables so droll that we think it well to call attention to it. In the year 1840, Mr. R. Mossman, of Thurston, near Dunbar, Haddingtonshire, Scotland, commenced a series of observations of rainfall which was continued for many years. An abstract of these records for the 12 years, 1841–52, is quoted in the United States tables as having been made in *York County, New Brunswick!*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1885.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute.				Average.				Absolute.		TotalRain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	90·4	26	47·6	9	76·6	54·7	49·8	67	129·3	40·5	·52	6	5·4
Malta	94·8	6	65·2	3*a*	87·3	69·6	65·7	66	147·6	...	·05	1	0·4
Cape of Good Hope	77·8	27	37·8	18	...	50·0	...	...	...	...	2·06	5	3·9
Mauritius	76·4	14	57·4	25	73·8	64·3	59·7	74	125·3	46·4	2·18	21	5·0
Calcutta	92·8	1	76·2	7, 9	88·7	78·5	78·8	86	160·5	75·0	8·12	28	8·5
Bombay	87·8	1, 5	74·7	17	85·1	77·5	76·3	83	145·0	73·7	21·81	30	8·6
Ceylon, Colombo	87·0	30	73·0	14	84·8	76·5	73·6	80	145·0	64·6	4·16	16	6·1
Melbourne	61·2	24	29·9	15	53·6	40·0	40·8	82	110·6	21·3	1·13	10	6·6
Adelaide	64·2	24	35·0	15	58·6	43·9	42·0	71	125·0	28·0	2·38	15	4·5
Wellington	57·5	8	33·0	22	51·6	42·0	42·6	86	115·0	30·0	4·32	22	4·9
Auckland	64·0	9	40·0	15	58·7	47·4	47·0	80	119·0	32·0	5·67	18	6·0
Jamaica, Kingston	93·2	23	70·8	3	88·9	73·3	72 1	73	...	...	1·03	...	4·3
Barbados	84·0	var.	70·0	8	83·0	73·0	75·5	85	147·0	...	2·26	12	5·0
Toronto	88·6	17	44·9	2	77·6	57·9	59·8	74	...	38·5	2·10	9	4·3
New Brunswick, Fredericton	88·7	25	46·5	3	79·0	55·0	57·8	74	...	...	3·61	13	4·9
Manitoba, Winnipeg	89·8	29	42·3	17	75·0	53·2	58·4	76	...	...	2·65	18	5·2
British Columbia, Victoria	83·0	7	43·0	17	71·6	50·3	...	...	...	...	·06	3	...

a And 11.

REMARKS, JULY, 1885.

MALTA.—Mean temp. 77°·8; mean hourly velocity of wind 5·8 miles; sea temp. rose from 76° to 83°. TS on 8th; temp. rose above 90° on ten days. J. SCOLES.

Mauritius.—Rainfall ·38 in., temp. 0°·3, and mean hourly velocity of wind 1·1 miles below average; extremes of velocity 25·5 miles and 1·7 miles. C. MELDRUM, F.R.S.

Melbourne.—Rainfall ·61 in., mean temp. of air 1°·4 and of dew point 0°·6 below their respective averages; humidity, pressure, and amount of cloud slightly above the averages; prevailing winds N. and N.E., strong on 3 days; L on 2nd, H on 28th, ice on 14th and 15th; hoar frost on 7 days, dense fog on 6. R. L. J. ELLERY, F.R.S.

Adelaide.—A beautiful month, rainfall and mean temp. slightly, and amount of cloud considerably below average; mean pressure unusually high. W. E. COOKE.

Wellington.—Very showery weather almost throughout, and cold with frequent fogs; some bright pleasant mornings, but wet mostly during the nights; prevailing winds S.E. and E., usually light or calm. Rainfall 2·03 in., and mean temp. 0°·9 below, mean pressure ·209 in. above average; H on 13th and 14th, sleet on 14th, slight earthquakes on 18th and 26th; fog on 7 days. R. B. GORE.

Auckland.—A stormy and rainy month, the rainfall being rather more than an inch above the average; mean temp. slightly above the average. T. F. CHEESEMAN.

JAMAICA.—The rainfall was only one half the average, and the continued drought was severely felt over the greater part of the Island. In the northern division, springs dried which are known to have flowed continuously for 40 years, cattle died in large numbers for want of grass and water, and cane fields were damaged, and in some instances destroyed. MAXWELL HALL.

BARBADOS.—Mean temp. slightly higher than the average; pressure somewhat lower; rainfall the smallest recorded in July. Prevailing wind N.E.; mean hourly velocity 14·1 miles, 25 per cent. above the average; extremes 25·8 miles on 4th and 5th, and 7·1 miles on 28th, 29th, and 30th. L on 5th and 6th; TSS on 21st; 5 days cloudy. R. BOWIE WALCOTT

SUPPLEMENTARY TABLE OF RAINFALL, JANUARY, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	4·22	XI.	Castle Malgwyn	5·94
,,	Margate, Birchington...	4·51	,,	Rhayader, Nantgwillt..	8·39
,,	Littlehampton	4·47	,,	Carno, Tybrith	5·75
,,	Hailsham	5·58	,,	Corwen, Rhug	5·55
,,	I. of W., St. Lawrence.	4·59	,,	Port Madoc	6·35
,,	Alton, Ashdell.....	4·33	,,	I. of Man, Douglas	4·37
III.	Winslow, Addington ...	3·15	XII.	Stoneykirk, Ardwell Ho.	3·73
,,	Oxford, Magdalen Col...	4·08	,,	Melrose, Abbey Gate...	4·33
,,	Northampton	2·60	XIII.	N. Esk Res. [Penicuick]	5·95
,,	Cambridge, Beech Ho...	2·41	XIV.	Ballantrae, Glendrishaig	3·76
,,	Wisbech, Bank House..	2·81	,,	Glasgow, Queen's Park.	3·37
IV.	Southend	2·56	XV.	Islay, Gruinart School..	5·48
,,	Harlow, Sheering	2·69	XVI.	St. Andrews, Pilmour Cot	2·46
,,	Rendlesham Hall	3·01	,,	Balquhidder, Stronvar..	11·29
,,	Diss	2·52	,,	Dunkeld, Inver Braan..	4·53
,,	Swaffham	2·69	,,	Dalnaspidal H.R.S. ...	6·46
V.	Salisbury, Alderbury...	3·33	XVII.	Keith H.R.S.	·63
,,	Warminster	4·03	,,	Forres H.R.S.	2·19
,,	Calne, Compton Bassett	3·82	XVIII.	Strome Ferry H.R.S....	6·57
,,	Ashburton, Holne Vic..	8·61	,,	Tain, Springfield.....	2·77
,,	Holsworthy, Clawton...	5·78	,,	Loch Shiel, Glenaladale	13·05
,,	Hatherleigh, Winsford.	3·90	,,	S. Uist. Ardkenneth ...	3·94
,,	Lynmouth, Glenthorne.	7·52	,,	Invergarry	5·96
,,	Probus, Lamellyn	6·22	XIX.	Lairg H.R.S.	...
,,	Wincanton, Stowell Rec.	3·90	,,	Forsinard H.R.S.	3·43
,,	Taunton.....	4·74	,,	Watten H.R.S.	3·17
,,	Wells, Westbury.....	4·42	XX.	Dunmanway, Coolkelure	6·30
VI.	Bristol, Clifton	4·92	,,	Fermoy, Gas Works ...	2·60
,,	Ross	5·10	,,	Tralee, Castlemorris ...	4·16
,,	Wem, Sansaw Hall.....	3·05	,,	Tipperary, Henry Street	4·38
,,	Cheadle, The Heath Ho.	4·02	,,	Newcastle West	5·29
,,	Worcester, Diglis Lock	3·36	,,	Miltown Malbay.....	4·66
,,	Coventry, Coundon	2·73	,,	Gorey, Courtown House	4·22
VII.	Melton, Coston	2·63	XXI.	Navan, Balrath	4·08
,,	Ketton Hall [Stamford]	3·07	,,	Mullingar, Belvedere...	3·66
,,	Horncastle, Bucknall ...	2·69	,,	Athlone, Twyford	3·53
,,	Mansfield, St. John's St	4·32	,,	Galway, Queen's Col....	4·31
VIII.	Macclesfield, The Park.	5·78	XXII.	Clifden, Kylemore	7·02
,,	Walton-on-the-Hill.....	3·39	,,	Tuam, Gardenfield	...
,,	Lancaster, South Road.	4·14	,,	Crossmolina, Enniscoe..	4·98
,,	Broughton-in-Furness ..	5·92	,,	Collooney, Markree Obs.	4·71
IX.	Wakefield, Stanley Vic.	2·89	,,	Carrick-on-Shannon ...	2·66
,,	Ripon, Mickley	3·98	XXIII.	Rockcorry.....	3·32
,,	Scarborough.....	3·84	,,	Warrenpoint	3·37
,,	EastLayton[Darlington]	1·94	,,	Newtownards	3·53
,,	Middleton, Mickleton..	4·27	,,	Belfast, New Barnsley..	5·46
X.	Haltwhistle, Unthank..	6·20	,,	Cushendun	8·26
,,	Shap, Copy Hill	7·46	,,	Bushmills	4·75
XI.	Llanfrechfa Grange	6·52	,,	Stewartstown	3·45
,,	Llandovery	6·10	,,	Buncrana	5·65

JANUARY, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	4·02	+ 1·67	·52	5	23	51·3	2	20·8	8	19	28
II.		Maidstone (Hunton Court)...	4·15	+ 1·58	·70	5	22	...	...	...	...	...	...
,,		Strathfield Turgiss	3·22	+ ·67	·58	5	22	52·3	2	17·5	7	20	28
III.		Hitchin	3·10	+ ·88	·29	24	23	49·0	2	17·0	7	29	...
,,		Banbury	2·79	+ ·41	·35	12	24	51·0	2, 3	15·5	8	24	...
IV.		Bury St. Edmunds (Culford)	2·71	+ ·87	·28	30	24	49·0	1*a*	20·0	18	28	...
,,		Norwich (Cossey)	2·59	+ ·89	·33	20	22	51·0	3	20·5	20	21	...
V.		Weymouth(LangtonHerring)	3·58	...	·48	27	22	...	...	...	...	...	...
,,		Barnstaple.....	6·06	+ 1·80	·90	25	24	54·0	3, 4	17·0	21	...	...
,,		Bodmin	8·02	+ 1·51	·92	28	29	51·0	3	20·0	21 *b*	12	22
VI.		Stroud (Upfield)	4·97	+ 1·98	·76	25	22	51·0	2	20·0	15	25	...
,,		ChurchStretton(Woolstaston)	4·24	+ ·81	·50	3	26	50·0	3	22·5	7	23	27
,,		Tenbury (Orleton)	4·17	+ 1·18	·55	27	24	54·2	2	13·0	8	20	24
VII.		Leicester	2·56	...	·37	25	19	51·0	3	25·2	19	19	30
,,		Boston	2·49	+ ·77	·35	10	19	50·0	1, 3	25·0	8 *c*	20	...
,,		Grimsby (Killingholme).....	3·11	+ 1·35	·39	10	23	50·0	1	19·0	20	13	...
,,		Hesley Hall [Tickhill].....	3·03	...	·56	11	19	...	...	...	...	...	...
VIII.		Manchester (Ardwick).....	4·92	+ 1·68	·83	12	23	50·0	1, 3	23·0	20	21	...
IX.		Wetherby (Ribston Hall) ...	3·92	+ 1·70	·64	31	20	...	...	...	...	...	...
,,		Skipton (Arncliffe)	9·51	+ 2·58	1·66	3	25	49·0	4	9·0	20	19	...
X.		North Shields	2·70	+ ·86	·40	9	19	54·8	1	17·5	19	19	20
,,		Borrowdale (Seathwaite).....	15·79	— 2·96	4·00	3	23	51·8	1	19·0	7	16	...
XI.	WALES.	Cardiff (Ely).....	5·44	+ ·73	1·15	30	23	...	...	...	...	...	...
,,		Haverfordwest	6·42	+ ·15	·93	7	14	51·0	3	17·0	20	12	19
,,		Plinlimmon (Cwmsymlog) ...	7·21	...	1·82	3	19	...	...	...	...	...	...
,,		Llandudno.....	3·57	+ ·61	·69	3	22	52·5	3	24·5	25	9	...
XII.		Cargen [Dumfries]	4·83	— 1·28	·51	7	20	51·6	3	14·0	19	19	...
,,		Jedburgh (Sunnyside).....	2·65	+ ·57	...	...	...	53·0	1	13·0	20	17	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	6·84	— 1·03	·71	25	20	...	...	...	...	...	...
,,		Oban (Craigvarren)	4·89	...	·56	8	20	51·8	1	22·0	18	14	...
,,		Mull (Quinish).....	6·17	...	·82	7	20	...	...	...	...	...	...
XVI.		Loch Leven Sluices	5·10	+ 1·28	·80	26	21	...	...	...	...	...	...
,,		Arbroath	2·76	+ ·31	·51	23	18	51·0	1, 3	17·0	19	17	...
XVII.		Braemar	3·17	+ ·39	1·00	24	20	51·8	2	−2·0	19	28	31
,,		Aberdeen	2·33	...	·32	23	20	57·0	1	15·0	6	17	...
XVIII		Lochbroom	6·80	...	1·39	1	27	...	...	...	...	...	...
,,		Culloden	2·26	+ ·49	...	...	...	51·0	1	11·0	19	17	28
XIX.		Dunrobin	...	...	...	...	...	...	...	...	...	...	...
,,		Kirkwall (Swanbister).....	4·89	...	·72	1	29	49·1	1	20·0	18	13	...
XX.	IRELAND.	Cork (Blackrock).....	3·64	— 2·38	·54	29	20	53·0	1*d*	22·0	6	15	...
,,		Dromore Castle	6·88	...	·80	3*e*	22	55·0	13	25·0	25	...	...
,,		Waterford (Brook Lodge) ...	2·47	...	·57	28	16	51·5	1	21·5	7	15	25
,,		Killaloe	4·80	...	·85	3	20	51·0	3	23·0	21	20	...
XXI.		Carlow (Browne's Hill)	3·43	— ·19	·67	5	22	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	3·24	+ ·98	·90	25	26	53·4	3	24·9	7	10	25
XXII.		Ballinasloe	4·00	— ·36	·65	3	23	49·0	3, 4	14·0	7	22	...
XXIII		Waringstown	3·97	+ ·56	·51	12	24	52·0	1*f*	16·0	6*g*	23	26
,,		Londonderry (Creggan Res.).	6·49	...	·70	12	30	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·26	+ ·49	·45	3	27	50·0	1*a*	17·0	6*g*	21	26

a And 2, 3. *b* And 23. *c* And 19, 20, 24. *d* And 3, 12. *e* And 19. *f* And 3, 22. *g* And 20.
+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON JANUARY, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather of the month was very variable. The heavy fall of S of 5th and 6th, thawed rapidly, but the night frosts retained it; turnips were damaged by rotting—the effect of frost after wet; a trying lambing season. On 8th the grass min. registered 6°·9. S on 8 days.

BANBURY.—A cheerless inclement month; S with alternating frost and thaw making the roads heavy and dangerous. Mean temp. (35°·9) slightly above the average. T, L and H on 13th, S on 11 days, fog on 4 days, high wind on 25th and 30th.

CULFORD.—There was a good deal of high wind during the month, and frost almost every night; on 5th, at 7 p.m., a short but severe storm of S and R with very high wind occurred, S fell also on 4 other days, sleet on 29th and 31st, fog on 26th.

LANGTON HERRING.—The weather of the month was most variable, the changes being very sudden. The rainfall was ·49 in. above the average for the last 11 years, and the mean temp. nearly three degrees below the average of 14 years. The ground was never covered with S, but the hills three miles away were white on 6th. On the morning of 13th a gale did considerable damage to the boats on the Chesil Beach, and uprooted trees inland. T and L on 17th, 18th, 19th and 25th, with very high wind on 25th; fog on 3rd, 4th and 11th.

BODMIN.—More S fell this month than has been seen since January, 1881, but the depth is difficult to ascertain as it was mixed with R. Mean temp. 37°·8. S and H on 17th and 18th, S on 7 other days.

STROUD.—A very cold wet month; snowdrops and aconites only just coming out at the close. H and T on 13th, S fell to the depth of 5 inches on 6th, and daily from 20th to 25th.

WOOLSTASTON.—A severe frost accompanied by frequent falls of S set in on 5th, and continued during nearly the whole of the remainder of the month. On the morning of 13th a terrific hurricane occurred lasting from 8.25 a.m. to 8.40 a.m., during which time the darkness was intense, little damage however was done. Mean temp. 34°·3. H on 4th, S on 14 days.

ORLETON.—The first three days were dry and warm; a steady fall of R then occurred, and the remainder of the month was very stormy and cold, with frequent S and R. The hills were covered with S the greater part of the month, although the depth of each fall was rarely more than one or two inches. Pressure very low and unsteady. Mean temp. 1°·7 below the average of 25 years.

LEICESTER.—The weather of the month was very changeable, but very cold and severe. A short but heavy storm occurred at 9.15 a.m. on 13th, and a heavy fall of S on 25th.

KILLINGHOLME.—There was much frost (though never intense), with alternate thaws more or less partial.

ARNCLIFFE.—More than the average number of S storms occurred during the greater part of the month, S having fallen on 15 days, and lying on 30th some 12 inches deep. L at night on 30th.

NORTH SHIELDS.—S on 12 days; H on 10th; fog on 27th and 28th.

SEATHWAITE.—Very heavy R on 3rd, causing floods. H on 4th. T and H on 15th. T, H and L on 29th. L on 23rd. Sleet on 7th, 8th, 16th and 28th.

WALES.

HAVERFORDWEST.—The month was characterized by sudden and abrupt changes of temperature, moisture, frost and thaw; it was impossible to predict what might happen even in a few hours; it was one of the most unpleasantly cold periods remembered. S fell frequently, and at times in large quantities, the depth of the first heavy fall being 5 inches, and of the second 7 inches. Short periods of severe frost occurred, followed by sudden and rapid thaw. The wind was principally N.W., N.E., and E.S.E.

LLANDUDNO.—The month was exceptionally dull and cold, and the aggregate amount of bright sunshine was only 33 hours, 13 absolutely sunless days being recorded. The mean temp., 38°·6, was 2°·8 below the average. There were occasional H showers and several falls of S, notably on 20th and 24th, the depth on the latter date being three and a half inches; the S, however, soon melted. The coldest period was from 17th to 27th. The extreme range of temp. (28°) was exactly the average, and the mean diurnal range (8°·4) half a degree below the average.

SCOTLAND.

CARGEN.—A dull gloomy month, with only 39 hours of sunshine, the average being 61 hours. Sudden and great fluctuations both of temp. and pressure prevailed to an unusual extent. Mean temp. (34°·4) 3°·9 below the average; H showers on 4th; S on 10th, 16th, and 25th; T and L on 30th.

JEDBURGH.—The weather was dull and cold, except on the first four or five days, with little sunshine. S on 10 days.

KILMORY.—T and L on several days; S on 12 days.

OBAN, CRAIGVARREN.—A cold month, singularly free from gales, and with a very moderate rainfall. It is believed that more S fell, and remained longer on the ground, than in any year of the previous quarter of a century. The temp. also was low.

BRAEMAR.—After the 4th frequent falls of S occurred, with continuous very severe frost; only 14 hours of sunshine were recorded.

ABERDEEN.—The weather during the month was of the usual wintry character, S, sleet, H and cold R prevailing. The R was just the average. Aurora on two nights; L on one.

LOCHBROOM.—The wildest January remembered here. Since the beginning of September last there have been only 37 dry days.

KIRKWALL, SWANBISTER.—An unusually severe month with S on 9 days; great gale on 8th; T on 15th.

IRELAND.

BLACKROCK.—A seasonable month, with much less S and severe frost than is reported from many parts. Mean. temp. (41°·1) one degree above the average for ten years.

DROMORE.—The weather generally was very cold and hard; about 3 inches of S fell on 6th, and lay for a considerable time; prevailing winds N.E. to N.W.

WATERFORD.—Mean temp. 36°·5. T and H on 13th.

KILLALOE.—A month of severe weather; from 11th to 26th the eight falls recorded were all S; frost was frequent. A heavy TS with vivid L occurred on 16th.

DUBLIN.—Although the new year opened with very mild dull weather, January will be remembered as a cold snowy month, but without severe frosts. S or sleet fell on 18 days, and H on 14; both the R and number of rainy days were much above the average, while temp. and pressure were as much below it, the max. temp. not exceeding 40° from 17th to 27th inclusive. Fog prevailed on 7 days, high winds on 13 days; a solar halo was seen on 28th. Mean temp. (37°·1) 3°·7 below the average; mean humidity 87; mean amount of cloud 6·6; prevailing winds W., S.W., and N.W.

BALLINASLOE.—S on 8 days. Heavy R, with L and T about noon on 16th; H and sleet on 30th.

WARINGSTOWN.—A very cold month, with almost continuous S.

EDENFEL.—The mild weather which marked December gave way on January 4th to S, and frost, which, with one or two short rainy intervals, continued throughout the month. The S which fell on 16th and 17th, and again on 30th and 31st, covered the ground to the depth of 6 and 9 inches respectively, being the heaviest falls for several years. A rather curious feature of the weather was that all the S came from the S.S.W., and when subsequently the wind settled in the N., it affected the night temp. only, which oscillated constantly between 17° and 32°, the day temp. of the same period being some degrees above freezing point.

SYMONS'S

MONTHLY

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THE GREAT SNOWSTORM, FEBRUARY 28TH TO MARCH 2ND.

THE fall of snow which took place on Sunday, February 28th, in many parts of England and Wales, continued in most districts without intermission until late on Monday evening, when there was a cessation more or less general in the South of England, and in most parts of the Midlands and in Wales. But the energy of the snow-charged depression was only removed further north, and during Monday a storm of greatly-intensified severity visited the northern counties of England and nearly the whole of Scotland, extending across the St. George's Channel to the eastern points of the Irish coast. Snow fell continuously for from 24 to 30 hours, and on Tuesday, March 2nd, was still falling over an area bounded by Northumberland on the south and Perthshire on the north, and continued to do so until midnight. It was accompanied by a high wind and a heavy sea on the East Coast, and on the principal railways the snow was drifted into huge wreaths, which entirely blocked the main lines of exposed districts, and filled the cuttings to a great depth. From all points accounts were received of passenger trains buried for hours in these drifts, and of great sufferings and inconvenience to the travellers; while mail communication between London and many of the northern cities was interrupted for nearly 24 hours.

The storm, though it spent its fury over a very wide area of country, was most violent in Scotland and in the belt of land between Newcastle-upon-Tyne and Berwick. The interruption to railway traffic was serious in 1875, but it was chiefly caused by heavy local falls of snow of short duration, or by the floods which followed the thaws. In 1878-9 there was also considerable annoyance experienced by occasional stoppages of railway communication. The winter of that year closely resembled the present winter in its long-continued low temperature, and for 90 years before 1878 there had been only four winters matching it for constant low temperature and long continued frost. Our present season of hard weather is in striking contrast to it, however, in one very important particular. The train stoppages on two or three lines in that year occurred in December,

when some locomotives ran overhead into deep drifts, and one dashed hissing into a railway station through a lake four feet deep. But the storm of this year burst forth on the 1st of March. In its violence, and the high wind which made it so disastrous, it has had no equal since 1853, as it has in many respects exceeded in its hardships the terrible storm of March, 1867, when highways were blocked up, sheep overblown, and mountain drifts covered the country.

The closest parallel was the January snowstorm of 1881, of which full details were given in this Magazine, when, for instance, no fewer than 51 trains were snowed up on the lines of the Great Western Company. The differences are chiefly two—that was in January, this in March; that was in the south of England, this chiefly in the border counties and the south of Scotland.

An Edinburgh paper gives the following notes on the distribution of pressure at the time of the recent storm, and as they have been printed in *Nature* as an original communication, it is not difficult to guess by whom they were written :—

For a fortnight previous to this memorable storm the weather maps of Europe presented several noteworthy features. Eastern and northern Europe was the theatre of a widely-extended anti-cyclone, slowly shifting its position from day to day, and sending out from its central region winds in all directions, differing much in their climatic qualities; whilst, on the other hand, western and south-western Europe was marked by an atmospheric pressure persistently much lower, with an unwonted absence of anything approaching a cyclone, which is usually a characteristic feature of the weather at this time of the year.

The anti-cyclone from February 15th to 19th had its centre about Moscow, during which time pressure rose till on the latter date the barometer at 32° and sea-level stood as high as 30·965 in., or nearly 31 in.; and at the same time temperature steadily fell, a temperature of —7°·6, or fully 7° below zero, being recorded at Moscow on the morning of the 19th. The anti-cyclone thereafter advanced northward and westward to the White Sea and the Gulf of Bothnia, a pressure of 30·961 in. being recorded at Haparanda on the 22nd, and of 30 922 in. at Uleaborg in Lapland on the 24th. Thereafter it advanced southward to Stockholm with a pressure of 30·603 in. on the 28th, to Riga with a pressure of 30·742 in. on March 1st, and to Gothland with a pressure of 30·300 in. on the morning of the storm. The central regions of this anti-cyclone were meanwhile marked by unusually low temperatures, the lowest being —16°·8 on the 23rd, and —18°·8 on the 24th, at Archangel, and —15°·5 on the following morning at Haparanda; these temperatures being about 30° below the average of the season at these places.

The weather maps of Europe show a noteworthy change to have already set in on the morning of the last of February, when the curvings of the isobaric lines, or lines of equal atmospheric pressure, pointed to the appearance of a cyclone to the north-east of the White Sea, and to another cyclone advancing from the south-west on the British Isles. Between these two cyclones, it will be observed, lay the anti-cyclone or region of high atmospheric pressure. On March 2nd the cyclones, with their systems of low pressures, travelled, the

more northern one somewhat to westward, and the more southerly one to eastward; and these respective movements were continued on the following day. In the meantime, the anti-cyclone between the two cyclones greatly shrunk in breadth, and by the morning of the storm lay as a narrow tongue of high pressure westwards over Scandinavia, and, meteorologically speaking unusually close on to the cyclone, whose centre was now about the Humber. It resulted necessarily from this high pressure immediately to the northward that the storm passed across the British Islands with uncommon slowness in its easterly course, thus prolonging its continuance in Great Britain; and that the steepest gradients were formed in the north-east quarter of the cyclone—a rather unusual feature in the storms of north-western Europe, thus exposing North Britain to one of the very worst easterly gales of recent years.

Similarly, our great Edinburgh hurricane of January 24th, 1868, occurred with a region of high atmospheric pressure immediately to the eastward, while to the east of this high pressure another cyclone raged at the same time. In this case, however, the cyclone, anti-cyclone, and cyclone lay in a series from east to west, and as the combined system advanced very slowly to eastward, this great hurricane blew persistently from the south over the whole country for many hours. On Tuesday last, on the other hand, the cyclone, anti-cyclone, and cyclone lay from S.S.W. to N.N.E., and as the centre of the more southerly cyclone crossed England from westward to the Humber, the whole of North Britain was on the arctic side of the storm, which therefore blew with a chill and a force which are happily of rare occurrence in our Scottish climate. As regards the amount and remarkable character of the snowfall, though science as yet can throw little light on the subject, it may be suggested that it was in some way connected with the remarkable weather described above, which overspread eastern and northern Europe during the fortnight preceding the storm.

We now proceed to give a very brief abstract of the reports which we have at present received. We do not pledge ourselves to the perfect geographical sequence of every detail, in fact, that is practically unattainable; but we aim at brevity, and the records are roughly in the order of latitude—from S. to N.

The most southerly place from which we have heard of actual stoppage of traffic is Bedford, but that is hardly a place where it could be very serious.

The Birmingham Tram-Car service was stopped.

The Cambrian Railway was blocked between Oswestry and Welshpool.

The Bala and Festiniog line was blocked at Trawsfynydd.

The Chester and Holyhead line was heavily over-blown near Penmaenmawr, but by the employment of a very large number of men all serious interruption was avoided.

The line was blocked at Corwen.

Llanberis Station was "snowed up."

The Isle of Man line was blocked.

In the towns of Lytham and Blackpool business was almost stopped.

The only part of the London & North-Western Railway which

was blocked, was between Preston and Lancaster, and that seems to have been only for a short time.

The Midland Railway had a serious block on the Settle and Carlisle line, near Dent, which was reported as impassable from the 1st to the morning of the 4th.

The Furness Railway, for the first time during 30 years, had one train snowed up.

The North Eastern Railway Company were the heaviest sufferers —in fact, the Directors are reported to estimate their loss at £100,000—£30,000 for labour and damages, and £70,000 for lost traffic, but we think that both items are beyond the truth. However, even if reduced to half, and judging from their ordinary traffic returns that does not seem unreasonable—we still have one snowstorm costing one railway company £50,000. We are told that besides the great block on their main line, of which we have more to say, there were blocks on the Malton and Scarborough at Seamer, on the Whitby line at Lofthouse and Saltburn, on the Filey branch at Hunmanby, on the old Stockton and Darlington system at Barnard Castle, and at Kirkby Stephen.

But the worst trouble was in the neighbourhood of Morpeth in Northumberland, where the main line of the North Eastern, over which runs that which we believe to be the finest train service in the world, the Great Northern to Edinburgh, was wholly blocked for a period generally reported as 60 hours, but which we think was really rather over 48 hours. There were blocks both South and North of Morpeth, in fact, one report states that between Newcastle and Berwick this company had 30 trains fast in the snow. None seem to have been able to move much on the 2nd, but on the 3rd there was improvement, and one line at any rate was rendered passable. The following is a condensed account of the fate of one of these trains. A train with two engines, nine carriages, one Pullman car, and four fish waggons, left Edinburgh at 10.50 p.m. on the 1st, got on tolerably to Berwick, but finally stuck in a drift about one mile S. of Acklington Station, between Alnwick and Morpeth at 4.45 a.m. on the 2nd, towards night of the 2nd four engines came and tried to pull them out, but could not, as the couplings gave way, but eventually some carriages were brought alongside and the passengers were offered the choice of returning to Acklington Station or remaining in the carriages. As food had been sent and there was a fire in the Pullman car most of the passengers remained in the train, which was eventually pulled through to Alnwick on the night of March 3rd.

As further evidence of the severity of the snow in the Morpeth district it may be mentioned that even as late as the night of the 5th, or according to another account the 6th, the Rothbury branch of the Northumberland Central line was blocked at Ewesley, eight miles W.N.W. of Morpeth.

We now pass into Scotland, where generally the trouble is confined chiefly to some of the South Eastern counties and to the Highland

line. But this time it was different, the Highland line did not suffer at all seriously, but the Caledonian and the North British railway were greatly disorganized—the latter company consider it the worst storm for 20 years. The North British lines were blocked at Jedburgh, Polton, Rosslyn, North Berwick, Haddington, Blackhall, Shotts, and Crofthead. The Kinross line was blocked till 9 p.m. on 3rd, and one train buried. On the Dunse and Reston line two trains with more than ninety passengers stuck fast. The train which left Galashiels at 10 p.m. on 2nd, stuck all night near St. Boswells. The train which left Boarhills for Anstruther on the morning of the 2nd, was on the 3rd still buried near Crail. A goods train which left Bathgate at 6 p.m. on 2nd, stuck at Westcraigs. The 6.40 p.m. (on 2nd) passenger train from Edinburgh to Coatbridge stuck at Armadale, and two engines sent to fetch it back also stuck fast. The 7.45 a.m. (on 3rd) train from Edinburgh also failed to get beyond Armadale, and no train passed from Bathgate to Morningside between the 2nd and 4th. Most of these blocks were removed on 3rd, but the main line between Innerwick and Berwick, and also the Glencorse branch were not clear on the 4th, and the Dolphinton branch of the Edinburgh and Galashiels line was still blocked on the 6th.

The Caledonian Railway fared much better—their Addiewell branch was blocked and one train buried; there was a serious block with four trains buried between Montrose and Arbroath; the Alyth line was blocked until the 3rd. A train was also buried near Forfar Junction on the Dundee and Forfar direct line.

The only block that we have heard of on the Highland line was one train buried at Dalwhinnie—but we think that that may be regarded as almost an annual occurrence.

There was a heavy fall of snow in the N.E. of Ireland, but we have no details.

We shall, of course, have much fuller information as to the depth of the snow when our correspondents' returns come in at the end of the month, but we give a few estimates without suggesting whether they are right or wrong.

Dalry	6 inches	Paisley..	14 inches.
Hamilton ...	12 ,,	Hawick	18 ,,
Jedburgh ...	14 ,,		

To this we may add that on March 4th there were taken out of Edinburgh 1434 cart loads of snow.

ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on Wednesday evening, Feb. 17th, at the Institution of Civil Engineers, Mr. W. Ellis, F.R.A.S., President, in the Chair.

Mr. G. Buchanan, M. Inst. C.E., Captain G. H. Leggett, Dr. H. C. Taylor, J.P. and Mr. J. Tolson were balloted for and duly elected Fellows of the Society.

The following papers were read :—

(1.) "General Remarks on the naming of Clouds," by Capt. H. Toynbee, F.R.Met.Soc. The author considers it important to keep to Luke Howard's nomenclature, leaving it to the observers to express by an additional word any peculiarity they notice in a particular cloud.

(2.) and (3.) "On the Thickness of Shower Clouds," and "On the Formation of Rain, Hail, and Snow," by Mr. A. W. Clayden, M.A., F.G.S. From some measurements of the angular elevation of clouds and of the position of their shadow, made by the author during the summer of 1885, he has come to the conclusion that clouds of less than 2,000 feet in thickness are not often accompanied by rain; and if they are it is only very gentle, consisting of minute drops. With a thickness of between 2,000 and 4,000 ft. the size of the drops is moderate. As the thickness gets greater, the size of the drops increases, and at the same time their temperature becomes lower, until, when the thickness is upwards of 6,000 ft. hail is produced. The author points out that all observations tend to show that, except under quite abnormal conditions, the temperature of the atmosphere falls as the height above sea-level increases; and that there seems no reason whatever for assuming that the law does not apply to that portion of the atmosphere which forms a cloud. Hence if a drop were to be formed at or near the upper surface of a cloud, it would fall into a region saturated with vapour at a temperature above its own. The result would be further condensation producing a larger drop; and this process would continue until it left the cloud. If its temperature is below the dew point of the air it falls through, condensation will continue until it reaches the ground. However, it is obvious that this subsequent gain cannot bear any very large proportion to the growth while falling through the saturated cloud, from which the conclusion follows that the size of the drop must increase with the thickness of the cloud. The author suggests that condensation begins on the upper surface of the cloud by the cooling of some of the liquid cloud particles. If this particle is cold enough it will solidify, and snow will be formed. Should it not be quite cold enough to solidify at once, owing to its minuteness, but remain still below the freezing point, hail is formed. Finally, if the temperature is not low enough for either snow or hail, rain is produced.

(4.) "On Three Years' Work by the 'Chrono-barometer' and

'Chrono-thermometer,' 1882-84," by Mr. W. F. Stanley, F.R.Met.Soc., The chrono-barometer is a clock that counts the oscillations of a pendulum formed by a suspended barometer. The upper chamber of the pendulum is a cylinder of an inch or more in diameter. By change of atmospheric pressure the mercury in the pendulum is displaced from the bottom to the top and *vice versâ*. The rate of the clock is accelerated or retarded in proportion to the displacement of the mercury. The chrono-thermometer is a similar clock to the above, and the pendulum is also a barometer, but instead of the lower chamber being exposed to pressure the whole tube is enclosed in a second hermetically sealed tube containing air. Atmospheric pressure being thus excluded, the expansion of the included air by heat alone, forces the mercury up into the vacuum chamber, and alters the period of oscillation of the pendulum. Therefore every vibration of each pendulum is an observation respectively of pressure or of temperature, and a subsequent reading of the dial gives the mean of as many observations as there have been beats of the pendulum say 86,000 per diem.

DEW.

A remarkable coincidence is to be found in the publication of Mr. Aitken's paper in our last number, and in the appearance of the following paragraph in the *Journal of Horticulture* issued on the following day, and reporting the proceedings at the Royal Horticultural Society on February 9th. The similarity of Mr. Smee's investigations to those of Mr. Aitken is noteworthy :—

LEAVES AND DEW.—Mr. Smee read an interesting communication on some observations he had made during nineteen days upon the relative amount of dew deposited on leaves of different plants last summer. He observed the Quince, Syringa, Brussels Sprouts, Peach, Rose, Mulberry, Evening Primrose, and Dahlia, at seven in the evening and again at nine in the morning. It appeared that the leaves of the Quince and Mulberry are always the last to be coated with dew, and are never very wet at any time. Dahlias and Brussels Sprouts become coated with dew sooner than any other plants ; while in the former, drops of dew hang from the points of every leaf. The leaves of the Peach, Rose, and Evening Primrose are never so wet as those of the Dahlia, but always had more moisture deposited on them than had those of the Quince and Mulberry. Mr. Smee also exhibited a table giving the atmospheric conditions in his garden on the days of his observations. The plants were all similarly situated as to exposure, and were, as far as practicable, growing in close proximity to one another.

REVIEW.

limatologie de la Ville de Fécamp, ses rapports avec la Météorologie du Département de la Seine Inférieure. Par CHARLES et EUGENE MARCHAND. Fécamp, 1886. 8vo, autographed.

ALTHOUGH this work, like several that we have been favoured with from France, is unpublished, we do not like it to pass unnoticed; and as a copy has been presented by M. Marchand to the Royal Meteorological Society it is generally accessible.

It may, by the bye, be worth while to call attention to the mode of production; it resembles the result of the glycerine transfer process for which there was a temporary rage in England about three or four years since, but which Englishmen have never succeeded in working so uniformly and so clearly as our French friends—even the almost microscopic writing of M. Marchand becomes, with adequate magnifying power, perfectly legible, and the neatness alike of diagrams, tables, and the 100 pages of text, leaves nothing to be desired. It certainly looks like a solution of the problem of £. s. d. which keeps much Meteorology in MS.

M. Marchand began his observations at Fécamp in 1853, the results of the first ten years were published by La Société Nationale Havraise d'Etudes diverses in 1864, and of the next 10 years in 1874. This latter summary was reviewed in the *Meteorological Magazine* for 1875 (Vol. X.) pp. 56 and 71. The book now before us deals with the third decade, in which M. Marchand was greatly helped by his deceased son, M. Charles Marchand.

Although running on very similar lines to those of the previous series it differs from them by the greater use made of diagrams, some of them very ingenious, and also by the incorporation of results from nearly 30 stations organized in the Department of la Seine Inférieure by the Ponts et Chaussées.

Referring to our previous notice for details we must pass the present work very briefly.

The mean temperature $\frac{(M + m)}{2}$ is 50°·2; absolute max. 92°·7, July 22, 1869; absolute min. 3°·9, Jan. 22, 1881; the mean sea level barometric pressure at noon, reduced to 32° for 30 years, 29·997 in. M. Marchand has collected all the noon readings of the barometer and sorted from them two groups with the following results:—

Days when it was low water about noon ...	29·928 in.
,, ,, high ,, ,, ...	29·895 in.

which he quotes as indicative of a lunar tide.

As regards state of sky, clouds, &c., M. Marchand has designed no fewer than 25 symbols, the whole of which we cannot discuss here, but we may mention that he makes the mean amount of cloud 6·8. In this section M. Marchand refers to his researches on

Photantitupimétrie, but as we reported fully upon them in an article entitled Sunlight,* we need not do so again.

The prevailing direction of wind both at Fécamp and throughout the department is discussed most carefully, but we have only space to state that it is very nearly due West at Fécamp, but markedly different at the various stations in the Department. The frontispiece shows clearly that many of these anomalies are due to the stations being in valleys along which the wind is obliged to blow.

The rainfall during the 30 years has been

Wettest year (1881)	52·49 in.	152.
Mean	34·50 in. or	100.
Driest year (1864)	24·06 in.	70.

M. Marchand then works up a very large collection of rainfall obervations made in the Department of la Seine Inférieure and gives them in a new and good form. He has taken a map of the Department, ruled it with squares about 3 miles × 3 miles, marked upon it the actually observed values and then filled into every square the value which he considers to be nearest the truth. He gives the maximum to the vicinity of Havre (36 inches), and the mininum to the extreme S.E. of his map towards Beauvais (22 inches).

In concluding sections the authors discuss the frequency, localities and damages of hail and of thunder storms, and also the frequency with which storm warnings are justified by subsequent events.

Our readers can now judge for themselves as to the interest of this work.

CUTTINGS.

THE RECENT SEVERE WEATHER IN AMERICA.

The late January storm is thus alluded to in the *American Cultivator* (Albany, New York) of January 21 :—"This storm in its extent, in the amount of snow which fell, in the average degree of cold, and the velocity of the wind, was a phenomenal winter tempest. Railroad traffic from the Atlantic to the eastern side of the Rocky Mountains was interrupted, scores of trains having been snowed in. The intense cold weather lasted until the morning of the 15th, when a general rise in temperature began. On the 12th, the thermometer registered at Bridgton, Main, 40° below zero ; at Peterboro, New Hampshire, —32° ; at Waterbury, Connecticut, —20° ; at Wichendon, Massachusetts, —25° ; at Lexington, Kentucky, —14°. In this city, on the 14th, it fell to 26° below the lowest point on that day recorded at any signal office in the country. Along the coasts scores of vessels suffered. Some were lost, and others were driven ashore. How many persons have been drowned cannot yet be ascertained. Hundreds of head of live stock perished from the cold. Over 250 hogs at the East Liberty (Pennsylvania) stock yards, and more than 500 head of cattle near Dodge City, Kansas, were frozen to death. Intelligence from the cattle regions of Texas reached us, January 14, saying that cattle were dying in great numbers. Their carcases, it was stated, could be seen, far and near, strewing

* *Met. Mag.*, Vol. XI., 1876, p. 1.

the prairies. The loss of the live-stock industry of that State, it is said, will be enormous. Advices from the western and south-western wheat belt state that the snowstorm with the recent severe cold has protected the wheat from all harm. At the south, the coldest weather known in many years prevailed, frost extending, it is believed, to almost the extreme southern end of Florida. There is little doubt that the entire orange crop remaining on the trees in the peninsula is frozen, and that most of the young trees, except those protected, are killed. It is estimated that 500,000 boxes of oranges, worth £200,000, were destroyed."

NEW SOUTH WALES IN DRY SEASONS.

That the squatting interest is greatly affected by dry seasons scarcely needs demonstrating, because where there is no rain, there is no grass. That New South Wales should have lost thirteen million sheep in three years from droughts is a very serious matter. It may, however, be mentioned that these droughts are by no means unprecedented, as some very interesting information recently furnished to Mr. H. C. Russell shows that some pioneer squatters have known the Darling quite as low as it was last year, if not lower. In 1839 this river was merely a chain of waterholes, and again, ten years afterwards, it was very little better. In 1851 the bed of the river was so dry that grass had grown in it, and, in fact, it was the only feed the horses could get. In 1863 the river was only a chain of waterholes from Bourke to Wentworth. In 1865, again, the cattle were fed in the bed of the river. In 1868 the water was low, and in 1870 the great wet season began. It was this wet season that raised so many false hopes. The country was overstocked —not for the good seasons but for the average seasons, and still more so for the bad seasons—and, as there were no railways to the far west, there was no means of shifting the sheep as the supply of feed fell off. Mr. Russell, however, thinks that there is a tendency for the seasons to repeat themselves every 19 years, and if this calculation should prove to be anywhere near the truth, it will enable squatters to adapt themselves to these changes. At present, all that Mr. Russell can say is that the condition of things in 1862 re-appeared in 1881, that of 1863 in 1882, and that of 1865 in 1884. The squatters are therefore hopeful that the great flood of 1867 will be reproduced in 1886. Meanwhile, it is clear that those who occupy the western half of the Colony have to encounter some very bad seasons intermixed with very good seasons. One of three things must be done : either the average quantity of stock must be kept down to the limit that is manageable in dry years, or artificial food must be provided, or there must be railway facilities furnished to carry the stock to other parts of the Colony where there is grass, or to some abattoirs where they can be killed and turned into tinned or frozen meat. The present system of stocking up in the good seasons, and then seeing half the stock die during the drought, is one that is not only wasteful but cruel.—New South Wales Correspondent in *The Colonies*, February 19th, 1886.

NATIVE AUSTRALIANS AS RAIN PREDICTORS.

Civilised people should not be altogether above taking a hint from "savages." It is reported from Northern Australia that the "blacks" have been recently quitting the low lands and making for the high grounds in anticipation of a heavy and prolonged rainfall, and in support of their claim to be considered good "clerks of the weather" it is stated that they foretold the

late drought, and came down to the valleys, so as to be near the water, long before the white settlers foresaw any signs of a dry spell.—*The Colonies*, February 19th.

ANTS AS RAIN PREDICTORS.

A gentleman residing a few miles from Rockhampton has called our attention (says the *Bulletin*) to a circumstance which seems to foretell an abundant supply of rain at an early date. The white ants, he states, have commenced to build those curious elevated dwellings which serve them as places of refuge during wet weather, and the country in our informant's neighbourhood is dotted over with the structures in every direction. Personal observation for a number of years has convinced him that this sign is one which may be relied upon, and it is a noteworthy fact that it is more than two years since these industrious little workers have been seen to take such a precaution for their own safety. Previous to the recent showers they remained perfectly quiescent, and their present activity may, therefore, presage a much more liberal downpour than any we have had for a long time. We can only trust that our informant's deduction may prove correct. On the Range it has also been observed that the white ants have been unusually active, and are working on the surface of the ground mound making.—*Brisbane Courier* (Queensland), November 9th, 1885.

THE BIELA METEORS—UNIVERSAL TIME.

To the Editor of the Meteorological Magazine.

SIR,—I take the liberty of calling your attention to an oversight in the December number of the *Meteorological Magazine*, p. 165.

In converting time at Georgetown, D.C., to Greenwich time, the fact has been overlooked that the time now used in the United States is not in general *true local* time, but that of the 75th, 90th, 105th and 120th meridians, West of Greenwich. Georgetown uses the 75th meridian, and is therefore just five hours slow of Greenwich.—Yours respectfully,

GEO. E. CURTIS.

Washington, D.C., February 18th, 1886.

[We are much obliged by the receipt of the above correction, and we profit by the re-opening of the subject to offer two remarks.

The illustration which the above error, and also the difficulty which we have ourselves experienced in ascertaining what time is employed at other stations, afford an example of the harm done by the rejection of the proposed "new time." We adhere to every word of the article on that subject in the *Met. Mag.* for January, 1885.

Secondly. It seems to us that as regards these meteors *true* local time at each place is the fact required; the meteors became visible owing to the earth turning from the sun, and therefore darkness coming on, and also to each part of the earth being successively turned towards that part of space where the stream was thickest. This, however, is an astronomical rather than a meteorological subject, and we therefore leave it. ED.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUG., 1885.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	79·3	17	43·3	14	69·2	51·0	49·5	72	93·2	36·7	·85	12	6·1
Malta	103·9		71·9	18	92·0	76·0	70·5	66	150·7	...	·35	1	1·5
Cape of Good Hope	72·2	3	36·0	10	62·4	47·3	...	...	...	...	4·24	10	6·1
Mauritius	77·2	27	59·8	19	74·8	65·4	60·2	73	127·6	47·0	2·76	19	5·3
Calcutta	89·5	12	75·7	24	85·9	77·7	77·8	89	154·7	74·9	26·50	28	9·2
Bombay	87·2	2	75·0	18	84·0	76·9	75·5	85	143·2	73·1	25·42	31	8·7
Ceylon, Colombo	88·0	30	71·2	14	86·5	77·7	73·7	76	146·0	64·4	2·66	14	5·5
Melbourne	77·0	20	31·7	1	59·7	44·2	39·9	65	127·3	22·5	1·56	10	6·0
Adelaide	74·3	18	38·0	24	62·5	47·7	43·7	66	131·9	30·9	2·34	19	5·2
Wellington	61·1	19	35·0	2*a*	54·5	42·4	43·8	85	118·0	30·0	2·82	17	4·3
Auckland	63·5	17	39·0	4	57·2	45·2	43·8	76	123·0	30·0	2·72	16	6·3
Jamaica, Kingston	92 5	13	71·4	7	89·3	73·8	73·0	75	...	...	·84	...	5·0
Barbados	84·0	var.	71·0	13	83·0	73·0	76·6	90	144·0	...	6·22	21	5·0
Toronto	83·1	1	43·2	28	71·1	55·1	56·0	75	...	38·2	3·91	14	6·2
New Brunswick, Fredericton	84·7	13	39·0	30	74·4	51·4	54·5	74	...	...	4·66	12	4·8
Manitoba, Winnipeg	81·2	15	30·5	24	70·8	47·6	52·3	79	...	...	1·94	13	5·4
British Columbia, Victoria	76·0	12	44·0	15	68·4	48·0	...	...	...	...	·02	1	...

a And 6, 11, 12.

REMARKS, AUGUST, 1885.

MALTA.—Mean temp. 83°·1; mean hourly velocity of wind 7·6 miles; temp. exceeded 100° on 3rd and 8th; sea temp. rose to 85° and afterwards fell to 82°. TS on 16th.
J. SCOLES.

Mauritius.—Rainfall 0·96 in., and mean temp. 0°·7 above average; mean hourly velocity of wind 11·3 miles, extremes 26·8 miles on 31st and 1·9 mile on 13th and 28th; prevailing direction of wind E.S.E. L on 5th, a very rare occurrence in August.
C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·6 above, and of dew-point 2°·2 below, average; rainfall 0·33 in., mean amount of cloud 0·2, and mean humidity and pressure slightly below their respective averages; prevailing winds N. and N.W., strong on 7 days, heavy dew on 4 days, hoar frost on 5; fog on 1st, L on 20th and 27th.
R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·0 above, but mean diurnal range nearly 2°·0 below the average for 28 years. A remarkable wind squall occurred on 14th, the wind travelling 18 miles in 8 minutes.
W. E. COOKE.

Wellington.—Fine from 8th to 12th, showery and squally from 2nd to 7th and 13th to 16th, remainder of the month fine with showery intervals; prevailing winds N.W. and S.E.; rainfall 2·51 in. below, and mean temp. 0°·5 above average. A rather sharp shock of earthquake on 5th.
R. B. GORE.

Auckland.—On the whole a fine month; rainfall considerably and mean temp. slightly below the average.
T. F. CHEESEMAN.

JAMAICA.—Over the island generally the long-continued drought gave place in August to average rains.
MAXWELL HALL.

BARBADOS.—Rainfall 25 per cent. below, and mean temp. (77°·2) slightly above the average; pressure unsteady; prevailing wind N.E.; mean hourly velocity 10·4 miles, 23 per cent. above the average, extremes 14·7 miles and 5·7 miles. T on 13th, 17th, and 28th.
R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, FEBRUARY, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	·47	XI.	Castle Malgwyn	2·02
,,	Margate, Birchington...	·69	,,	Rhayader, Nantgwillt..	2·43
,,	Littlehampton	·55	,,	Carno, Tybrith	1·63
,,	Hailsham	·38	,,	Corwen, Rhug	·90
,,	I. of W., St. Lawrence.	·72	,,	Port Madoc	3·34
,,	Alton, Ashdell.....	·42	,,	I. of Man, Douglas	2·09
III.	Winslow, Addington ...	·63	XII.	Stoneykirk, Ardwell Ho.	2·01
,,	Oxford, Magdalen Col...	·68	,,	Melrose, Abbey Gate...	1·29
,,	Northampton	·51	XIII.	N. Esk Res. [Penicuick]	1·55
,,	Cambridge, Beech Ho...	·20	XIV.	Ballantrae, Glendrishaig	2·55
,,	Wisbech, Bank House..	·12	,,	Glasgow, Queen's Park.	1·75
IV.	Southend	·36	XV.	Islay, Gruinart School..	2·60
,,	Harlow, Sheering	·18	XVI.	St. Andrews, Pilmour Cot	1·23
,,	Rendlesham Hall	·29	,,	Balquhidder, Stronvar..	3·32
,,	Diss	·28	,,	Dunkeld, Inver Braan..	1·49
,,	Swaffham	·39	,,	Dalnaspidal H.R.S. ...	2·32
V.	Salisbury, Alderbury...	·82	XVII.	Keith H.R.S.	·68
,,	Warminster	·89	,,	Forres H.R.S.	·92
,,	Calne, Compton Bassett	·88	XVIII.	Strome Ferry H.R.S....	3·26
,,	Ashburton, Holne Vic..	2·85	,,	Tain, Springfield	1·24
,,	Holsworthy, Clawton...	1·03	,,	Loch Shiel, Glenaladale	4·85
,,	Hatherleigh, Winsford.	...	,,	S. Uist. Ardkenneth ...	2·76
,,	Lynmouth, Glenthorne.	·49	,,	Invergarry	2·87
,,	Probus, Lamellyn	2·42	XIX.	Lairg H.R.S.	·75?
,,	Wincanton, Stowell Rec.	·68	,,	Forsinard H.R.S.	1·20
,,	Taunton.....	·90	,,	Watten H.R.S.	1·40
,,	Wells, Westbury.....	·59	XX.	Dunmanway, Coolkelure	4·83
VI.	Bristol, Clifton	·82	,,	Fermoy, Gas Works ...	2·33
,,	Ross	1·22	,,	Tralee, Castlemorris ...	2·77
,,	Wem, Sansaw Hall.....	·73	,,	Tipperary, Henry Street	3·04
,,	Cheadle, The Heath Ho.	·88	,,	Newcastle West	2·33
,,	Worcester, Diglis Lock	1·29	,,	Miltown Malbay.....	2·98
,,	Coventry, Coundon	·86	,,	Gorey, Courtown House	3·61
VII.	Melton, Coston	·25	XXI.	Navan, Balrath	1·52
,,	Ketton Hall [Stamford]	·30	,,	Mullingar, Belvedere ...	2·52
,,	Horncastle, Bucknall ...	·46	,,	Athlone, Twyford	2·92
,,	Mansfield, St. John's St	·62	,,	Galway, Queen's Col....	2·65
VIII.	Macclesfield, The Park.	·68	XXII.	Clifden, Kylemore	5·26
,,	Walton-on-the-Hill.....	1·12	,,	Crossmolina, Enniscoe..	3·15
,,	Lancaster, South Road.	1·30	,,	Collooney, Markree Obs.	2·74
,,	Broughton-in-Furness ..	2·31	,,	Carrick-on-Shannon ...	2·95
IX.	Wakefield, Stanley Vic.	·39	XXIII.	Rockcorry.....	..
,,	Ripon, Mickley	·88	,,	Warrenpoint	3·49
,,	Scarborough.....	1·03	,,	Newtownards	1·39
,,	East Layton [Darlington]	1·63	,,	Belfast, New Barnsley..	2·83
,,	Middleton, Mickleton ..	·90	,,	Cushendun	2·36
X.	Haltwhistle, Unthank..	·98	,,	Bushmills	...
,,	Shap, Copy Hill	1·70	,,	Stewartstown	2·64
XI.	Llanfrechfa Grange	1·53	,,	Buncrana	3·52
,,	Llandovery	1·69			

FEBRUARY, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg	Max. Date	Min. Deg.	Min. Date	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·63	— 1·01	·30	2	8	47·7	13	19·4	10	18	26
II.		Maidstone (Hunton Court)...	·38	— 1·24	·13	3	5	...	...	...	...	...	...
,,		Strathfield Turgiss	·60	— 1·15	·27	3	7	50·0	13	18·0	10	21	26
III.		Hitchin	·33	— 1·27	·11	14	8	44·0	13	21·0	8*a*	27	...
,,		Banbury	·66	— 1·18	·17	28	9	48·0	14	22·0	10	24	...
IV.		Bury St. Edmunds (Culford)	·24	— 1·53	·06	14	9	45·0	13*b*	16·0	9	27	...
,,		Norwich (Cossey)	·33	— 1·42	·10	14	11	45·0	13	19·0	10	25	...
V.		Weymouth(LangtonHerring)	·86	...	·50	28	7	49·0	13	26·0	10*c*	14	...
,,		Barnstaple	1·32	— 1·87	·70	28	8	50·0	13*b*	26·0	10	...	...
,,		Bodmin	1·98	— 2·89	·65	13	12	47·0	12	27·0	5*d*	13	18
VI.		Stroud (Upfield)	·69	— 1·56	·21	28	9	47·0	13	23·0	6	22	...
,,		ChurchStretton(Woolstaston)	·69	— 1·81	·18	15	10	47·0	11	22·0	24	22	26
,,		Tenbury (Orleton)	1·25	— 1·22	·45	28	8	48·8	12	21·3	15	22	25
VII.		Leicester	·31	...	·10	15	7	48·5	13	24·5	7	19	27
,,		Boston	·11	— 1·67	·05	14	4	47·0	13	25·0	7*e*	23	...
,,		Grimsby (Killingholme).....	·67	— 1·13	·27	1	14	45·0	13	25·0	24	16	...
,,		Hesley Hall [Tickhill].....	·56	...	·22	19	12	48·0	13	23·0	27	...	...
VIII.		Manchester (Ardwick).....	·77	— 1·42	·22	13	10	48·0	13	27·0	5*c*	11	...
IX.		Wetherby (Ribston Hall) ..	1·00	— 1·15	·28	2	8	...	...	...	...	...	...
,,		Skipton (Arncliffe)	1·12	— 3·52	·27	13	11	47·0	8	18·0	6	10	...
X.		North Shields	1·36	— ·48	·35	25	14	49·0	10	21·0	20	19	21
,,		Borrowdale (Seathwaite).....	3·72	— 7·73	1·70	13	11	45·5	16	19·9	26	16	...
XI.	WALES.	Cardiff (Ely).....	1·90	— 1·76	·88	28	11	...	...	...	...	...	...
,,		Haverfordwest	2·61	— 1·84	·71	13	11	53·0	13	20·0	4	16	23
,,		Plinlimmon (Cwmsymlog) ...	2·14	...	·47	2	12	...	...	...	...	..	...
,,		Llandudno.....	1·70	— ·59	·85	13	11	50·0	12	25·4	26	12	...
XII.	SCOTLAND.	Cargen [Dumfries]	1·88	— 1·93	·56	13	13	44·8	13	14·8	5	17	...
,,		Jedburgh (Sunnyside).....	·68	— 1·08	...	...	...	46·0	12*f*	17·0	5	19	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory)	2·55	— 1·84	·55	13	15	...	...	...	..	...	...
,,		Oban (Craigvarren)	2·67	...	·73	13	11	50·1	10	24·1	4	14	...
,,		Mull (Quinish).....	3·07	...	·79	12	12	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·50	— 1·46	·30	14*g*	8	...	...	...	...	...	...
,,		Arbroath	1·50	— ·66	·24	19	14	46·0	9	21·0	20	15	...
XVII.		Braemar	1·46	— 1·21	·85	13	14	44·7	9	2·5	5	25	27
,,		Aberdeen	1·98	...	·27	13	20	49·0	10	23·0	5	20	...
XVIII		Lochbroom	2·11	...	·41	12	13	...	...	...	...	...	...
,,		Culloden	1·22	+ ·17	...	...	...	49·5	13	20·0	5	15	24
XIX.		Dunrobin	1·41	...	·27	14	13	53·0	9	26·5	1	16	...
,,		Kirkwall (Swanbister)..... ..	1·84	...	·30	24*h*	22	47·8	9	22·5	25	11	...
XX.	IRELAND.	Cork (Blackrock)	4·02	— ·57	1·06	28	18	53·0	8	26·0	14	7	...
,,		Dromore Castle	5·64	...	1·12	22	17	58·0	9	28·0	14	...	...
,,		Waterford (Brook Lodge) ...	3·72	...	·78	22	18	49·5	10	21·5	5	5	16
,,		Killaloe	2·44	...	·57	6	14	53·0	9	26·0	15	10	...
XXI.		Carlow (Browne's Hill)	2·95	+ ·03	·53	14	15	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·98	— ·18	·52	28	15	53·4	8	27·3	5	4	18
XXII.		Ballinasloe	2·17	— ·34	·41	6	19	51·0	8	22·0	5	21	...
XXIII		Waringstown	2·37	+ ·12	·57	6	15	53·0	8	23·0	3	14	23
,,		Londonderry (Creggan Res.).	2·66	...	·44	21	18	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·01	+ ·73	·70	6	14	49·0	9	20·0	4	19	22

And 9, 23. *b* And 14. *c* And 24. *d* And 26. *e* And 9, 27. *f* And 13. *g* And 19. *h* And 28.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather was favourable for agricultural operations, and the land was generally in good condition and friable, though at the commencement it was very wet, with R and S. Young wheat was none the worse for the long spell of wintry weather. No spring corn had been planted at the close of the month, but lambing was making good progress. S on 28th Primrose in flower on 4th, snowdrop on 8th.

HITCHEN.—The coldest February since 1855. The ice was safe for skating here from the New Year to the close of the month, with the exception of three days.

BANBURY.—A very cold and disagreeable month; mean temp. (34°·0) 4°·0 below the average. S on 2nd, 3rd, and 28th; fog on 6th, 10th, 11th, and 23rd; high wind on 14th and 28th.

CULFORD.—Scarcely any sunshine throughout the month, and N. and N.E. winds prevailed; S on 23rd and 27th.

COSSEY.—A very cold and dry month.

LANGTON HERRING.—The driest February for the last 12 years, the R being 2·37 in. below the average, and the coldest for 15 years, the mean temp. at 9 a.m. being 6°·7 below the average, and 1°·4 lower than that of the next coldest February, that of 1873; the highest min. temp. was only 41°·0, but the ground has not been covered with S so far this winter, and there have been no storms. Several days were misty, and there was an absence of sunshine. N.E. winds were very frequent, and except on the first three days of the month the pressure was high; it was misty on seven days, foggy on one.

BODMIN.—A dry and very cold month; mean temp. 39° 9.

STROUD.—A very cold backward month, the temp. falling as low as 25°·0 in shade on six days, besides the min. of 23°·0 on 6th. S on 22nd and 28th.

WOOLSTASTON.—A very cold month, the ground being frozen on all but two nights; mean temp. 33°·9. S on five days.

ORLETON.—A very cloudy, foggy, and gloomy month. with a steady, persistent frost, and a few fine days. The mean temp was 6°·8 below the average of 25 years, and lower than that of any February for more than 30 years. The ground was lightly covered with S at the beginning of the month, and a heavy fall occurred after 3 a m. on March 1st, covering the land to a depth of 5 inches by 9 a.m. Pressure was high and generally steady.

LEICESTER.—The month was very dry and exceedingly cold.

BOSTON.—The mean temp. was 6° 0 below the average, and the lowest since 1864. Pressure was usually high, and the winds calm.

KILLINGHOLME.—A month of real winter weather; frosts occurred nightly, and when the sun shone it was powerless against the polar wind; temp. reached 40°·0 on only four days. After the first two days pressure was high and steady.

ARNCLIFFE.—S on 20th, 22nd, and 28th.

NORTH SHIELDS.—S on ten days, fog on eight days

SEATHWAITE.—A fine but cold month, ushered in by a S storm and T on 1st; S fell on 6th, 22nd and 28th, and on the hills on 20th.

WALES.

HAVERFORDWEST.—A very wintry month, with several falls of S; severe frost with keen E. and S.E. winds prevailing from the 12th to the close. A heavy E.N.E. gale occurred on 12th, and a violent S E. gale on 28th, in which two vessels were lost, the one off St. David's Head, and the other on the north coast off Fishguard. This was accompanied by the heaviest S storm since January 18th, 1881, some of the drifts being 10 feet in depth, and had not the temp. very rapidly risen on March 1st, the roads would have been impassable.

LLANDUDNO.—The mean temp. of the month was no less than 4°·6 below the

average, and my record, which extends back to 1861 inclusive, shows no such low temp. except on two occasions, viz., 1873 and 1879, and in these cases the weather was much less changeable. The mean daily range (8°·7) and the total range (24°·6) were slightly below the average; the coldness of the weather was not caused by the intensity of the frost, but by a persistent and almost uninterrupted low temp. The ground was covered with S on the morning of the 14th, but it soon melted, and this was the only S that fell during the month. Up to 13th, the weather was cool, and on the whole pleasant, being characterized by a considerable amount of sunshine, the total duration being 55 hours. E. winds prevailed from 16th to 18th inclusive, and again from 23rd to the close.

SCOTLAND.

CARGEN.—A very dull foggy month, with the lowest mean temp. (34°·7) recorded in 26 years, being 5°·3 below the average. Fifty-three hours of sunshine were recorded, the average being 89 hours. Pressure was above the average. S on 5th, 19th, 25th and 28th.

JEDBURGH.—The weather was remarkably cold and ungenial throughout; vegetation was at a standstill and farmwork very far behind. Spring flowers, though above ground, did not develop, except the yellow aconite, and the birds were heard on only one day, the 10th. Pressure was much above the average.

OBAN.—The coldest and driest February known in recent years; there was comparatively little S, and not a single gale during the month, which is considered the worst in the year for gales. S on five days.

BRAEMAR.—A very cold cheerless month with only 41 hours of sunshine.

ABERDEEN.—Till 5th, N.W. winds were prevalent, thereafter S. breezes continued till 18th, when S.E. winds set in, accompanied by S and H showers; the weather was in consequence very cold and stormy; the R, however, was somewhat below the average. S, often mixed with H and sleet, on 13 days.

LOCHBROOM.—On the whole a good month, though cold; frost was very constant and intense; there was no S of any consequence on the low ground, but a thick covering on the hills.

CULLODEN.—A severe month, with occasional S; frost prevailed during the entire month, and in consequence all field labour as well as garden work was at a standstill.

SWANBISTER.—There was a remarkable absence of gales during the month, but showers of S or sleet fell on 12 days. The min. temp. was below 30° on 1st, 4th and 25th only; pressure was high from 4th to 10th, and 15th to 28th inclusive; steady S.E. winds prevailed from 19th to 28th; L on 1st; H on 19th and 23rd.

IRELAND.

DROMORE.—A very cold month, prevailing winds E.N.E.

WATERFORD.—There was much E. wind during the month, and much frost, though not very severe; S on Comeragh and Carlow mountains on 14th, S with E. wind on 28th, about six inches deep with great drifts.

KILLALOE.—The R was below the average, half the month having been dry and fine with low temp.; S and cold E. wind on 28th.

DUBLIN.—A cold month, February having only once been colder during the previous 20 years, namely in 1873, when the mean temp. was 37°·1, that of this month being 38°·9, 4°·0 below the average; the diurnal range of temp. was small on many occasions. Sleet or S fell on 14th, 27th and 28th; H on 1st, 25th, 27th and 28th. Solar halos on 12th, 13th and 15th; fog on 14 days, high winds on 5 days. Mean humidity, 86; mean amount of cloud, 7·3; prevailing winds S.E., S.W. and E.

EDENFEL.—A cold cheerless month, beginning and ending with S, and with frost on 22 nights; farm labour, however, was not much interrupted, and this locality seems to have suffered less than others more favourably situated. S on five days.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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THE COLD AND THE SNOW STORM.

Since our last number appeared, we have been favoured with a very large mass of material, and our own regular March reports have been received. All confirm the impression mentioned in our last, that for all practical purposes the storm may be regarded as similar to that of January, 1881, but prevailing over a more northern district. We learn that Mr. C. Harding, F.R.Met.Soc., is preparing a report on the recent cold period, for presentation to the Royal Meteorological Society, and, therefore, acting upon our uniform practice, we have forwarded to him all the information which we have received, so that all who wish for the complete account will find it in the Society's *Quarterly Journal*.

We must, however, add two or three illustrative letters, and we must also thank the many correspondents who have supplied us with details, many of which, though not printed, have been very useful in checking the records of snow sent by our own regular correspondents.

To the Editor of the Meteorological Magazine.

SIR,—Perhaps it may interest you to know that we have been visited with, considering the season, an exceptionally severe snowstorm. It began blowing, coupled with very small snow, early on Monday morning (1st), but during the night more snow fell, and the drift began in real earnest, so that on going out yesterday (Tuesday) for a short time, I found drifts on the low ground close to the house, four to six feet deep, the top of many of them being level with the hedgetops. It was no use trying to clear the roads, as they would have blown up again as fast as they were cut. To-day it cleared and the wind dropped, and I got some men together to open out the roads, and, on going down, found the depth of the drifts in many places, where they were cut, six feet, at least, or more.

Yesterday (Tuesday), the postman arrived two hours late, he only comes from Cornhill, 4½ miles off; no mails in that morning; he left the station at 10.45, and the 8 a.m. from Kelso, due at 8.27, had not arrived, though only 10 miles; neither had the train

from Berwick-on-Tweed (reverse way), due at 9.11, come in. He was unable to return yesterday, and went off to-day, intending to return to-morrow, so we did not get any letters or papers either Tuesday or to-day. The block is as serious a one here as that of January, 1881, was in the south, (I was in town at that time), and worse than it was here, as there was not then any wind to cause a drift. I cannot say I ever recollect such a drift so late in the season as March. I have seen no papers since it began, so cannot tell how far it may have extended.

Previous to this storm, many of the hill farmers, at the top of Bowmont Water and Upper Coquetdale had to bring down their sheep to the lower ground near here; so that these lowground farms were in many cases over-stocked. What they will do now I cannot tell; I fully expect to hear of a great loss among sheep. The drift was almost entirely from the east. I remain, yours truly,

B. P. SELBY.

Pawston, Cornhill-on-Tweed, March 3rd, 1886.

March 4th.—P.S. I find there was a drift here in March, 1881, when I was away, but nothing near so bad as this. Several persons to whom I have spoken, and who have been long resident in the district, have to go back 33 years (1853) before they can recollect anything so bad after January. I *believe* there was as bad a drift, or nearly so, in February, 1853. A railway cutting on the new Alnwick and Cornhill branch at Kilham, about two miles from here, and fifty feet or so deep, is blown up so thoroughly that no one would think that there was a cutting at all. B. P. S.

To the Editor of the Meteorological Magazine.

SIR,—The great snowstorm of March 1st and 2nd was in some respects the most severe I ever knew. It snowed here incessantly, as far as I observed, for 50 hours, up to 9 a.m. on the 3rd—though at times very slightly, and it may have ceased at some time. The snow drifted very much, so that it was impossible to tell the exact depth, but as near as I could judge it was two inches at 2 p.m., ten inches at 10¼ p.m. of the 1st; and 12½ inches deep at 8 a.m. on the 2nd; and it reached a maximum of about 14 inches on the 3rd. The amounts caught in the rain-gauges, when melted, gave approximately ·86 and ·80 of an inch on the 1st, in my new and old gauges respectively; and ·36 and ·55 on the 2nd; but owing to the drifting these amounts would be very inaccurate. The most probable amount, judged by taking the average of the snow gathered and melted from five different spots, is 1·07 in. for the 1st, and ·53 for the 2nd; but, as the five quantities obtained differed widely, it is impossible to judge exactly.

To your list of snowed-up trains and impediments to traffic there should be added that on the 2nd inst. a train became imbedded in the snow between Seaham Harbour and Sunderland; two engines sent to its assistance were also snowed up, and railway communica-

tion between the two towns became wholly suspended, as well as between this town and Hartlepool. The deepest drift on road or railway in this district was probably in the railway cutting at Fulwell, a short way out of Sunderland, where the snow was said to be 18 ft. deep, probably somewhat of an exaggeration; which, with accumulations at other points, completely stopped the train service between Sunderland and Newcastle, and Sunderland and Shields, for many hours. A train becoming fixed in this drift at night on the 2nd (Tuesday) blocked one line of rails till (Saturday) the 6th, when the last carriages were extricated. The Newcastle and Jarrow line was also blocked, and I believe others. I doubt whether such a stoppage to railway communication ever occurred before in this district.

The snowstorm most resembling the late one of any I have known was that of 1881, March 4th and 5th, on which occasion the total yield was heavier, but as it was partly sleet the depth here was much less.

The weather has continued very snowy ever since the great storm, snow or sleet falling with little interruption, though at times very slightly, from the morning of the 15th to last evening; it mostly did not lie, and the total fall when melted was only ·45 in.

T. W. BACKHOUSE.

Sunderland, March 18th, 1886.

To the Editor of the Meteorological Magazine.

SIR,—The cold of the past season having been most severe in the period which included the second half of February, and the first half of March, a better idea may be gained of its character by a discussion of observations from the middle of February to the middle of March, than by taking the months separately.

From my own observations the mean temperature of the period of 31 days from February 15th to March 17th, was 32°·6. The maximum of the period was 45°·4 on March 17th; the minimum 21°·6 on March 7th, which was also the lowest of the winter. On March 4th, the grass thermometer registered 16°·0 on snow.

The mean temperature of February was 34°·8. This, although much below the average, will not bear comparison with the mean of February, 1855, which was the coldest month in my records. The mean temperature of that month was 29°·3, and the mean of 41 days from January 15th to February 24th, was as low as 28°·7. In the frost of January, 1881, we had a period of 19 days with a mean temperature of 25°·2.

The mean temperature of the first 17 days of the present month of March, was even lower than that of the 31 day period first referred to. It was 32°·2. The dryness of the air during the same time was not less remarkable than the cold. On March 9th, at 5.45 p.m., the reading of the dry bulb was 36°·7, of the wet bulb 28°·7, the difference 8°, the humidity, by Glaisher's tables, 43. The mean temperature of evaporation for the whole period of 17 days was 29°·9, and the mean humidity 73.

For rarity of occurrence the low mean temperature of the first 17 days of March was perhaps the most noteworthy feature of the season. I believe it has had no parallel since 1845. March, 1845, was a month of very unusual rigour. On the 14th, I recorded a minimum of 11°, and as late as the 21st, there was skating in this neighbourhood on ice from 4 in. to 5 in. thick. The Greenwich temperatures for that month confirm my own observations, the mean temperature of the first 21 days having been as low as 30°·4.

The deepest snow here during the past winter was 3 in. on the morning of the 1st of March.

As a remarkable contrast to the foregoing particulars it may be added that the thermometer to-day has reached a maximum of 64°·6.

GEORGE F. BURDER, M.D.

Clifton, March 24, 1886.

To the Editor of the Meteorological Magazine.

SIR,—In case you are collecting any statistics as to the recent storm the following table of min. temperatures observed here may be of interest. The shaded thermometer was in a Stevenson's screen, and the surface of the ground is 55 ft. above mean sea level :—

Date.	Min. in Shade.	Min. on Snow.
March 4	23·6	17·7
,, 5	11·2	0·4
,, 6	18·7	14·9
,, 7	8·4	—5·4
,, 8	8·5	0·3
,, 9	14·9	6·1
,, 10	10·2	—1·2
,, 11	24·2	15·0
,, 12	27·4	21·6
,, 13	30·2	24·6
,, 14	25·3	14·5

As to the fall of snow on the 1st, the depth in the open was about 7 in. yielding when melted 0·63 in.; it was a good deal drifted, in some places as high as the hedges. The cold does not seem to have done much harm to vegetation, the wheat was well covered with snow and is now looking pretty well, certainly very much better than at this time last year. Roots have kept very well considering the number of alternations of frost and thaw. Birds suffered a good deal, especially blackbirds and thrushes, of which large numbers are dead. In March, 1883, when the weather was very similar, though the snow was not so deep, the lowest readings were 5°·3 in the shade, and —2°·2 on the snow.—Yours truly,

H. MELLISH.

Hodsock Priory, Worksop, March 29, 1886.

METEOROLOGICAL AND ASTRONOMICAL RECURRING PERIODS.

To the Editor of the Meteorological Magazine.

SIR,—About 20 years ago I stated that remarkably cold winters and extremely hot summers usually recurred after intervals of about 40 years. The rule appears to be, that if a very hot summer is not repeated at the end of 39 years it is at the end of 40 years, and if a very cold winter does not return at the end of 40 years it does at the end of 41 years. Severe frosts are recorded as having occurred in 1659, 1669, 1699, 1709, 1740, 1745, 1749, 1755, 1774, 1780, 1789, 1820, 1827, 1830, and 1841, and they returned at the end of 40 years, in each case, in 1699, 1709, at the end of 1739, in 1749, 1780, 1785, 1789, 1795, 1814, 1820, 1829, 1860, 1867, 1870, and 1881. Latterly the very severe winters have returned more frequently at the end of 41 years, as 1789 in 1830, 1795 in 1836, 1797 in 1838, 1800 in 1841, 1814 in 1855, 1820 in 1861, 1830 in 1871, 1838 in 1879, and 1845 in 1886. In 1845 the long hard winter broke up just about the equinox, as it did this year.

Extremely mild winters seem more rare than extremely severe ones, but they also are generally repeated after an interval of 40 or 41 years. The remarkably mild winters of 1806, 1819, 1828, 1834, and 1843, returned after such an interval in each case, in 1846, 1859, 1869, 1874, and 1884.

With regard to summers, a great many remarkably hot ones have been repeated at the end of 39 or 40 years. Also at the end of 68 years. The cycle of 425 years, however, seems to be the best in this respect. Extremely hot or dry summers are stated to have occurred in 1022, 1276, 1277, 1289, 1345, 1354, 1393, 1394, and 1447, and they returned after an interval of 425 years in each case, in 1447, 1701, 1702, 1714, 1770, 1779, 1818, 1819, and 1872 respectively. Luke Howard thought that "periodical changes in a climate must be astronomical and not local." I have always thought so too. The weather cycle of 40 years does not appear to be so connected with lunar influence as some other cycles appear to be. There seems to be a lunar influence at work, but it does not appear sufficient to make it look like the best of all the meteorological cycles applying to winters. These two cycles of 40 and 425 years certainly seem to be the best, both astronomically and meteorologically. While searching for another explanation for the superior character of these two cycles, I discovered what I am not aware that anyone else has noticed, that there are remarkable astronomical cycles which correspond to those meteorological periods. There is a notably near commensurability between the periodic times of the Earth, Venus and Mercury, 40 of the earth's orbitual revolutions being almost equal to 65 revolutions of Venus, and also nearly equal to 166 revolutions of Mercury. Then 425 of the earth's sidereal revolutions are nearly equal to 1765 such revolutions of Mercury,

691 of Venus, and almost equal to 226 such revolutions of Mars. The following tables will show this :—

	Sidereal Revolution in Days.		Number of Revolutions.		Days.
Mercury	87·9693	×	166	=	14603
Venus	224·7008	×	65	=	14605
The Earth	365·2564	×	40	=	14610
Mercury	87·9693	×	1765	=	155266
Venus	224·7008	×	691	=	155268
The Earth	365·2564	×	425	=	155234
Mars	686·9797	×	226	=	155257

Those who deny that the foregoing statements possess any meteorological value, will at least admit that they reveal remarkable astronomical facts.

I am, yours, &c.,

GEORGE D. BRUMHAM.

Barnsbury, 3rd April, 1886.

HISTORY OF BAROMETERS.

THE usual monthly meeting of the Royal Meteorological Society was held on Wednesday evening, March 17th, at the Institution of Civil Engineers, Mr. W. Ellis, F.R.A.S., President, in the chair. Mr. W. E. Addison, Mr. A. W. Claydon, M.A., F.G.S., Mr. T. B. Moody, R.N., and Dr. W. Schlich were balloted for and duly elected Fellows of the Society. The President gave an historical sketch of the barometer. After remarking on the accidental nature of the discovery of the instrument in the year 1643, in its best form, in ignorance for some time of its value for purposes of meteorological inquiry, he gave a brief account of many early kinds of barometers, the first endeavour being in consequence of difficulties experienced with the ordinary mercurial form to enlarge the scale of variation, attempts which, in general, introduced other errors and inconveniences. The desire to experiment on elevated positions induced the construction of an early form of portable barometer, one such with cistern completely closed, leaving the air to communicate through the pores of wood having been made above 200 years ago. The President further described various points in the arrangement of the Ramsden, Gay Lussac, and other barometers, including also mention of some modern patterns of long range barometers, standard barometers, and such barometers as are more commonly used. The practice of driving out air from the mercury by heating or boiling appears to have been in use early in the last century. Engraved plates indicating the weather to be expected, with different heights of the mercury, have been longer used, at least as early as 1688. As regards correction for temperature, De Luc in the last century adopted a temperature corresponding to 54°·5 Fahr. as that to which to make reduction, because it corresponded nearly to the average of observations; this reduction is now made to the freezing point,

32° F. Reference was made to the employment of water (as in the well-known Royal Society barometer) and other liquids instead of mercury; also to various kinds of floating and other barometers not at all or not entirely mercurial, and to metallic barometers. The President concluded his account with a sketch of the history of recording barometers or barographs, including a notice of the application of photography and electricity to recording purposes.

At the conclusion of the President's address, the meeting was adjourned to afford the Fellows and their friends an opportunity of inspecting the valuable and interesting exhibition of barometers.

EXHIBITION OF BAROMETERS.

A very valuable, indeed unprecedentedly fine collection of different forms of barometer was brought together, and where it was not possible to obtain a specimen of the instrument a photograph or illustration of it was shown. The Exhibition therefore practically included almost every known form of barometer.

The instruments were classified under the following headings :— Mercurial Barometers : Adjustable Cistern, Closed Cistern, Siphons; Barographs; Aneroids; Metallic and other forms of Barometer. There were altogether 78 barometers, 9 new instruments, and 33 drawings, photographs, &c., making 120 exhibits. The catalogue, a copy of which was presented to all visitors, occupies 12 pages.

Some very fine specimens of standard barometer on the Fortin principle were exhibited—Mr. P. Adie showing one with a glass plunger to raise the mercury in the cistern, Mr. Casella showing another with the scale figured to tenths of an inch, and Messrs. Negretti and Zambra showing a third with cistern and tubular casing square in section. By the side of these were placed a portable barometer, with ivory float, about 100 years old, and a standard barometer, by Barrow, the pattern used by the members of the British Meteorological Society about 1850—60. Messrs. Negretti and Zambra exhibited a self-compensating barometer with a double rack moved by one pinion, so that, when adjusting the vernier in one position, the second rack moves in the opposite direction, carrying along with it a plunger, which is the exact size of the internal diameter of the tube. This firm also showed a standard barometer with electrical adjustment, and a new standard barometer with overflow cistern adjustment. Some interesting specimens of mountain barometers were exhibited, including one originally used by the North American Boundary Commission in 1857, which since its return has been employed by the Kew Committee on the inter-comparison of the various standard barometers of this country.

Among the closed cistern barometers was a large cistern one made for the Meteorological Society of London in 1837 by Mr. R. C. Woods. The proportion of the calibre of the tube to that of the cistern is as 1 : 50, a proportion which was considered sufficient to obviate the necessity for applying the capacity correction ! The tube and cistern originally held 70 lbs. of mercury ! The next instrument

to this was the Kew barometer, first designed in 1853, in which the cistern is closed and the scale contracted so as to obviate the necessity of correction for capacity. Specimens were exhibited of the marine barometer, as supplied to Her Majesty's ships previous to 1854; the Kew marine barometer, as adopted by the Admiralty; the gun barometer, with the glass tube packed with india-rubber to check the vibration caused by gun firing; and the coast barometer. The Meteorological Office showed patterns of barometers as used in France, Holland, and Russia. Two specimens of long-range barometer were exhibited, viz. Morland's diagonal, by Messrs. Negretti and Zambra, in which the top part of the tube is inclined more or less from the perpendicular to give an enlarged scale-reading; and Hicks's spiral tube, which gives a range of 8 inches for 1 inch variation of atmospheric pressure.

Among the siphon barometers were two very old forms, viz. Amonton's double barometer and a Dutch barometer, by Reballio, combining siphon and long-range barometer, thermometer, and hygrometer. An interesting relic was the mounting of the travelling-barometer formerly belonging to, and used by, De Luc. The siphons included Gay Lussac's, Bunten's, Jones's, Adie's, Dollond's, Bogen's, and Wild's forms of barometer; also a siphon designed by Capt. J. B. Basevi, R.E., and used by him in the high table-lands of Tibet, in connection with the operations of the Great Indian Trignometrical Survey; Stanley's barometer, with "rising and falling" index; and Guthrie's sensitive barometer which has a flat horizontal spiral in which is a bubble of air for indicating the variations of atmospheric pressure, the motion of the bubble being four and a half times that of the true barometric variation.

A specimen of Milne's barograph was shown by the Meteorological Office, while Messrs. Negretti and Zambra exhibited their improved form of the same instrument in which the paper is carried on a cylinder. M. Redier, of Paris, sent two forms (large and small) of his barograph, which works so satisfactorily; and MM. Richard Frères, of Paris, in addition to sending a self-recording mercurial barometer, exhibited several specimens of their self-recording aneroid, which is becoming so popular in this country. This instrument consists of a series of eight vacuum-boxes, by which the effects of the atmospheric pressure are increased and transmitted by a system of levers to an arm carrying a pen. The pen, of a special form, contains an ink mixed with glycerine, and marks the curve of atmospheric pressure on the paper round the cylinder, which revolves once in seven days. This firm also showed a Bourdon's metallic recording barometer, in which the drum turning in eight days is supplied with a continuous band of paper, serving for six months or a year.

Various specimens of aneroids were exhibited, including skeleton aneroid, showing the various working parts; aneroid with altitude scales; pocket watch aneroid, indicating heights to 20,000 feet; Stanley's surveying aneroid; Field's engineering aneroid; aneroids as supplied to Her Majesty's ships previous to 1854, and the pattern

now adopted; and self-registering aneroid with maximum and minimum indexes. Messrs. Lund and Blockley exhibited a barometer by M. Redier of Paris, with a dial 6 feet in diameter, the hand of which is kept in its true position by a single aneroid vacuum box; it is admirably adapted for the inside or outside of public buildings.

Mr. Stanley showed his chrono-barometer, which is a clock that counts the oscillations of a pendulum formed by a suspended barometer. The upper chamber of the pendulum is a cylinder of an inch or more in diameter. By change of atmospheric pressure the mercury in the pendulum is displaced from the bottom to the top, and *vice versâ*. The rate of the clock is accelerated or retarded in proportion to the displacement of the mercury.

Among the other forms of barometer were Jordan's glycerine barometer, the cistern and upper part of the tube only being shown, as the instrument, when complete, would be about 30 feet in height; Cetti's long-range mercurial and glycerine barometer; Hicks's flexible barometer; Lowne's handy weather-glass; Ronketti's thermo-barometer; Wilson's differential barometer; and several patterns of sympiesometer.

The most interesting of the new instruments was Immisch's pocket metallic thermometer. This is a watch-shaped instrument, and about the size of a small locket. The index-hand is actuated by the expansion and contraction of a very small Bourdon tube filled with a highly expansive liquid, and hermetically sealed, the motion of the tube being multiplied by an ordinary rack and pinion.

THE RAINFALL OF THE CAPE OF GOOD HOPE.

There is now being exhibited at the Commercial Exchange, a map illustrative of the annual rainfall of the colony, including the Free State. This map has been compiled in Mr. Gamble's office, and should be seen by all interested in the welfare of the colony. The colouring, showing the rainfall, was determined by Mr. Gamble from rainfall measurements collected by him, and enables one to see at a glance which districts are most favoured by rain. In illustration of the extent to which trees in the mass cause the clouds to fall in rain, it may be noted that the only place where the rainfall was over 54 in. was at Wynberg and the immediate vicinity; at Cape Town and neighbourhood—equally near the sea—the fall being 43 in. The only other place in the colony approaching this is the Zitzikama, where there is a large forest. The Gough, in the middle of the colony, had only 4 in. of rainfall during the whole year, a portion of Calvinia only 2 in., and Namaqualand and Bechuanaland from 2 in. to 5 in. The rainfall all over the Free State, and right down through the colony to the sea board, from the Kei River to the borders of Alexandria, is shown by one large patch of red, signifying that the fall has been singularly regular, varying from 18 to 30 in. Only one small patch of green appears in this vast tract of country, namely, at Cathcart and the Great Waterberg, where 31 in. of rain were registered during the year. The map shows most graphically what no amount of writing in the press has yet brought home, that our total rainfall is ample. It is only in the absolute necessity for extensive storage that we differ from what we choose to call more favoured countries.—*Cape Argus, March* 15, 1886.

[It will be remembered that in a recent number (*Met. Mag., Jun.*, 1886), Mr. Tripp gave a map similar to that above described; we understand that Mr. Gamble's map will be shown at the Colonial Exhibition.—Ed., *Met. Mag.*]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPT., 1885.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	76·5	15	33·7	27	64·8	48·4	48·4	78	116·3	27·7	4·30	19	5·5
Malta	95·1	27	63·1	19	84·0	69·3	62·6	63	143·9	60·0	·38	2	1·4
Cape of Good Hope	83·3	19	40·7	12	71·7	51·2	...	...	...	...	1·54	4	3·1
Mauritius	78·0	21	61·0	29	75·7	66·2	61·4	74	134·3	50·3	3·59	21	5·5
Calcutta	90·0	9	73·2	10	87·3	77·9	77·9	87	155·0	72·0	5·51	17	7·4
Bombay	89·3	29	73·9	17	85·6	76·4	75·4	82	149·8	69·1	12·01	21	6·2
Ceylon, Colombo	89·0	8	74·8	29	87·3	77·5	72·2	72	146·8	65·0	3·97	17	6·1
Melbourne	75·0	4	40·0	6	61·0	47·2	45·7	75	124·3	30·2	3·93	14	7·4
Adelaide	77·0	10	40·0	14	65·6	48·9	44·5	63	138·2	32·9	1·63	14	5·7
Wellington	62·5	17	36·5	14	56·6	43·7	45·1	84	122·0	34·0	2·42	15	3·6
Auckland	66·5	30	37·0	11	59·7	48·5	45·4	67	130·0	30·0	2·33	15	6·9
Jamaica, Kingston	91·6	9	71·6	28	88·7	74·2	73·3	78	...	...	5·11	...	6·1
Barbados	86·0	26	70·0	11	83·0	73·0	77·1	87	145·0	...	5·36	19	5·0
Toronto	82·5	26	38·1	23	66·9	46·7	49·8	76	...	33·4	3·62	6	4·1
New Brunswick, Fredericton	74·8	14	32·0	26	65·2	42·0	45·6	77	...	...	4·15	10	4·3
Manitoba, Winnipeg	81·1	28	25·3	30	66·7	39·5	44·6	74	...	...	·72	9	5·4
British Columbia, Victoria	71·0	3	42·0	25	64·6	47·8	...	...	...	...	4·00	18	...

Remarks, September, 1885.

Malta.—Mean temp. 76°·0; mean hourly velocity of wind 8·0 miles, velocity 20 miles per hour from 8 a.m. to 4 p.m. on 12th; the sea maintained a temp. of 78°·0; TS on 9th. J. Scoles.

Mauritius.—An unusually wet and cloudy month. Rainfall 1·78 in. and mean temp. 0°·5 above their averages; mean hourly velocity of wind 12·0 miles, extremes 29·0 miles on 2nd, and 2·7 miles on 30th, prevailing direction E.S.E. C. Meldrum, F.R.S.

Melbourne.—Rainfall 1·60 in., mean temp. of air 0°·8 and of dew point 2°·1, mean amount of cloud 1·3, pressure ·082 in., and humidity 4 above their respective averages; prevailing winds N. and W., strong on 7 days; T on 10th, L on 13th, heavy dew on 19th. R. L. J. Ellery, F.R.S.

Adelaide.—Mean temp. 0°·2, mean pressure ·084 in. and mean amount of cloud slightly above their averages; mean diurnal range of temp. 2°·3 and rainfall slightly below their averages. W. E. Cooke.

Wellington.—Fine up to 4th; from 4th to 10th showery and generally cold; from 11th to 25th generally fine though showery at times, and cool; remainder of the month very stormy. Mean temp. 0°·9 and rainfall 2·16 in. below their averages; T and L on 5th, L on 4th and 8th, H on 9th. R. B. Gore.

Auckland.—The early part of the month was squally and unsettled with strong S.W. winds, the middle very fine with moderate S. and S.W. winds. Rainfall considerably below and pressure above their averages; mean temp. about the average. T. F. Cheeseman.

Barbados.—Rainfall 57 per cent. below the average; mean temp. (77°·2) exactly the average; pressure somewhat unsteady; wind N.E. on 29 days, mean hourly velocity 8·0 miles, 8 per cent above the average, extremes 15·2 miles and 3·7 miles; TSS on 6 days. R. Bowie Walcott.

SUPPLEMENTARY TABLE OF RAINFALL, MARCH, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·72	XI.	Castle Malgwyn	4·91
,,	Margate, Birchington...	·81	,,	Rhayader, Nantgwillt..	6·44
,,	Littlehampton	2·69	,,	Carno, Tybrith	5·12
,,	Hailsham	2·04	,,	Corwen, Rhug	4·03
,,	I. of W., St. Lawrence.	3·11	,,	Port Madoc	6·10
,,	Alton, Ashdell.....	2·04	,,	I. of Man, Douglas	4·10
III.	Winslow, Addington ...	1·94	XII.	Stoneykirk, ArdwellHo.	3·95
,,	Oxford, Magdalen Col...	1·61	,,	Melrose, Abbey Gate...	4·55
,,	Northampton	1·67	XIII.	N. Esk Res. [Penicuick]	2·70
,,	Cambridge, Beech Ho...	1·31	XIV.	Ballantrae, Glendrishaig	4·14
,,	Wisbech, Bank House..	1·94	,,	Glasgow, Queen's Park.	2·58
IV.	Southend	1·00	XV.	Islay, Gruinart School..	3·48
,,	Harlow, Sheering	1·35	XVI.	St.Andrews, PilmourCot	(2·57)
,,	Rendlesham Hall	1·34	,,	Balquhidder, Stronvar..	6·35
,,	Diss	1·48	,,	Dunkeld, Inver Braan..	3·94
,,	Swaffham	1·73	,,	Dalnaspidal H.R.S. ...	4·20
V.	Salisbury, Alderbury...	2·09	XVII.	Keith H.R.S.	(1·35)
,,	Warminster	2·33	,,	Forres H.R.S.	·85
,,	Calne, Compton Bassett	1·86	XVIII.	Strome Ferry H.R.S....	3·28
,,	Ashburton, Holne Vic..	8·08	,,	Tain, Springfield.....	1·05
,,	Holsworthy, Clawton...	3·06	,,	Loch Shiel, Glenaladale	6·25
,,	Hatherleigh, Winsford.	2·89	,,	S. Uist. Ardkenneth ...	2·49
,,	Lynmouth, Glenthorne.	3·44	,,	Invergarry	3·63
,,	Probus, Lamellyn	3·82	XIX.	Lairg H.R.S.	...
,,	Wincanton, StowellRec.	2·64	,,	Forsinard H.R.S.	1·08
,,	Taunton.....	2·58	,,	Watten H.R.S.	1·01
,,	Wells, Westbury.....	2·35	XX.	Dunmanway, Coolkelure	11·20
VI.	Bristol, Clifton	2·81	,,	Fermoy, Gas Works ...	3·54
,,	Ross	3·19	,,	Tralee, Castlemorris ...	4·37
,,	Wem, Sansaw Hall.....	2·35	,,	Tipperary, Henry Street	2·34
,,	Cheadle, The Heath Ho.	3·81	,,	Newcastle West	2·54
,,	Worcester, Diglis Lock	2·23	,,	Miltown Malbay.....	3·54
,,	Coventry, Coundon	2·41	,,	Gorey, Courtown House	2·88
VII.	Melton, Coston	2·58	XXI.	Navan, Balrath	3·65
,,	Ketton Hall [Stamford]	2·27	,,	Mullingar, Belvedere...	3·38
,,	Horncastle, Bucknall...	2·57	,,	Athlone, Twyford	4·50
,,	Mansfield, St. John's St	3·54	,,	Galway, Queen's Col....	4·18
VIII.	Macclesfield, The Park.	2·73	XXII.	Clifden, Kylemore	8·25
,,	Walton-on-the-Hill.....	2·25	,,	Crossmolina, Enniscoe..	4·49
,,	Lancaster, South Road.	4·11	,,	Collooney, Markree Obs.	3·06
,,	Broughton-in-Furness..	8·31	,,	Carrick-on-Shannon ...	4·06
IX.	Wakefield, Stanley Vic.	1·51	XXIII.	Rockcorry.....	2·76
,,	Ripon, Mickley	3·24	,,	Warrenpoint	5·02
,,	Scarborough.....	1·94	,,	Newtownards	2·52
,,	East Layton[Darlington]	3·48	,,	Belfast, New Barnsley..	3·01
,,	Middleton, Mickleton..	1·74	,,	Cushendun	1·97
X.	Haltwhistle, Unthank..	3·15	,,	Bushmills	...
,,	Shap, Copy Hill	5·97	,,	Stewartstown	2·81
XI.	Llanfrechfa Grange	4·86	,,	Buncrana	3·13
,,	Llandovery	7·50			

[The figures in parenthesis on this and the next page have been corrected for doubtful measurements of snow.]

MARCH, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·38	— ·23	·38	1	14	62·2	24	22·1	7	18	19
II.		Maidstone (Hunton Court)...	1·33	— ·25	·20	1*a*	14	...	...	...	...	...	...
,,		Strathfield Turgiss	1·21	— ·19	·22	1	12	68·4	23	18·4	7	19	21
III.		Hitchin	1·28	— ·20	·28	1	15	61·0	21	20·0	6	17	...
,,		Banbury	1·95	+ ·35	·32	29	16	61·0	21	16·0	7	18	...
IV.		Bury St. Edmunds (Culford)	1·77	+ ·21	·35	1	14	62·0	28	16·0	16	17	...
,,		Norwich (Cossey)	1·12	— ·57	·32	1	16	61·0	21	23·0	8	19	19
V.		Weymouth(LangtonHerring)	3·17	...	·47	28	17	58·0	24	22·0	7	16	...
,,		Barnstaple.....	3·07	+ ·58	·57	30	11	59·5	26	22·5	17	...	...
,,		Bodmin	3·93	+ ·77	·56	19	18	61·0	24	22·0	13	13	15
VI.		Stroud (Upfield)	2·45	+ ·64	·60	30	16	64·0	24	20·0	6	17	...
,,		ChurchStretton(Woolstaston)	2·83	+ ·67	1·06	30	17	60·5	24	21·5	10	19	20
,,		Tenbury (Orleton)	3·19	+ 1·32	1·14	30	15	63·0	24	13·5	7	18	19
VII.		Leicester	2·36	...	·49	29	12	64·5	24	17·5	7	17	20
,,		Boston	2·39	+ 1·10	·55	1	13	62·0	21	16·0	7	18	...
,,		Grimsby (Killingholme).....	2·41	+ ·75	·71	1	20	60·0	23*b*	19·0	7	15	...
,,		Hesley Hall [Tickhill].....	2·58	...	·85	1	19	63·0	23	11·0	8	18	...
VIII.		Manchester (Ardwick).....	2·17	— ·28	·50	30	14	62·0	25	25·0	7	14	...
IX.		Wetherby (Ribston Hall) ...	2·81	+ ·68	1·44	1	11	...	...	...	...	...	...
,,		Skipton (Arncliffe)	7·04	+ 2·28	1·25	1	19	60·0	24	10·0	6	20	...
X.		North Shields	2·97	+ 1·52	...	...	17	62·0	25	15·5	7	17	18
,,		Borrowdale (Seathwaite).....	9·93	+ ·04	2·82	26	20	63·0	24	11·5	7	18	...
XI.	WALES.	Cardiff (Ely).....	4·25	+ 1·56	·73	20	15	...	...	...	...	...	...
,,		Haverfordwest	5·17	+ 1·98	1·17	26	15	60·0	23	17·0	12	17	20
,,		Plinlimmon (Cwmsymlog) ...	6·15	...	1·63	30	13	...	...	...	...	...	...
,,		Llandudno.....	2·55	+ ·67	·70	1	15	63·0	23*c*	22·5	14	17	...
XII.		Cargen [Dumfries]	5·13	+ 2·35	1·38	26	16	65·8	24	15·0	7	17	...
,,		Jedburgh (Sunnyside).....	2·95	+ 1·38	·76	27	16	63·0	24	8·0	7	18	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	3·50	— 1·11	·52	30	16	...	...	...	...	...	...
,,		Oban (Craigvarren)	3·05	...	·59	26	16	61·4	23	23·1	13	13	...
,,		Mull (Quinish).....	3·91	...	·45	22	16	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·70	+ 1·58	·50	17*b*	14	...	...	...	...	...	...
,,		Arbroath	2·74	+ 1·11	·46	26	13	57·0	21*d*	23·0	7	14	...
XVII.		Braemar	3·10	+ ·91	·67	16	18	58·8	29	2·0	12	16	25
,,		Aberdeen	2·67	...	·66	19	23	60·0	22	19·0	11	18	...
XVIII		Lochbroom	(2·28)	...	·61	30	10	...	...	...	...	...	...
,,		Culloden	...	...	...	...	...	..	...	...	...	...	...
XIX.		Dunrobin	1·34	...	·35	19	10	59·0	25	24·0	7	16	...
,,		Kirkwall (Swanbister)..... ..	1·52	...	·29	30	18	53·9	22*a*	24·4	6	..	...
XX.		Cork (Blackrock)	6·59	+ 3·83	·80	26	18	59·0	21	27·0	3	10	...
,,		Dromore Castle	5·73	...	·60	12	22	58·0	22	25·0	2	...	...
,,		Waterford (Brook Lodge) ...	4·22	...	·75	26	15	53·5	21	22·5	13	13	19
,,		Killaloe	2·70	...	1·03	26	15	59·0	21	19·0	4	16	...
XXI.	IRELAND.	Carlow (Browne's Hill)	2·31	+ ·20	·55	26	16	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·07	+ ·34	·46	26	19	60·4	21	23·0	4	12	21
XXII.		Ballinasloe	3·72	+ 1·34	·66	26	19	58·0	21*e*	19·0	4	18	...
XXIII		Waringstown	2·87	+ ·81	·64	26	18	67·0	24	19·0	4	18	22
,,		Londonderry (Creggan Res.).	2·46	...	·39	27	18	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·95	+ ·86	·59	26	17	56·0	21*f*	22·0	3, 12	20	...

a And 26. *b* And 27. *c* And 24. *d* And 22. *e* And 23. *f* And 23, 25.
+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON MARCH, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—Cold E. winds with fog, and frost at night, prevailed all through the first part of the month, and continued far on into the latter part, pastures being bare and spring sowing at a standstill until about 17th, when a genial and timely change in the weather, with a very rapid rise of temp., occurred. A thrush's nest, with two eggs, seen on 18th; peacock, brimstone and tortoiseshell butterflies seen on 23rd. S on 1st and 6th; TS on 31st; gale on 26th.

HITCHEN.—The mean temp. of the latter part of the month, after the frost broke up on 17th, was the highest ever recorded in March: 48° at night, and 61° in the day.

BANBURY.—Mean temp. (38°·7) 2°·0 below average; on each of the first 12 days the mean temp. was below 32°; the last week was very stormy and windy. S on six days, sleet on two, fog on five, high wind on three.

CULFORD.—Up to 15th, the weather was very cold with frequent S, after which it became more genial, although the wind at times was very high. L and T with H on 29th.

COSSEY.—Frost prevailed every night to 18th inclusive.

LANGTON HERRING.—Rainfall 1·48 in. above the average for 11 years; in temperature the first 16 days presented a most striking contrast to the last 15, the mean temp. from 1st to 16th being 10°·8 below, and that from 17th to 31st 3°·6 above, the average. The mean temp. at 9 a.m. from 1st to 16th was lower than that for any month in 14 years, except January, 1881; the mean min. for the same period being the lowest without exception; the mean temp. of the whole month was 3°·8 below the average. Dense fogs prevailed from 19th to 23rd, and fog on many other days. The second half of the month was very wet; T on 31st.

BODMIN.—A very cold ungenial month, with 15 days of blasting E. wind; mean temp. (40°·9) 3°·3 below the average.

STROUD.—The first half of the month was very cold; the last half warm, wet and windy. S.W. gales on 26th and 30th; high wind, with H, sleet and L, on 31st.

WOOLSTASTON.—The severe frost of the last two months continued till the 19th, when a rapid thaw set in; mean temp. 37°·5; severe gale with H on 30th; S on five days.

ORLETON.—S fell early on the morning of 1st, covering the ground to the depth of six inches, and remained on all the high lands till the 19th. The first 18 days were very cold, with severe frost every night, and frequent light falls of S; the mean temp. at 9 a.m. for that period being 31°·5, the lowest registered here for so many consecutive days in March; on 19th a change of wind to S. took place, with a great rise of temp., which continued to the end of the month, the mean for the last 13 days being about 18° higher than that of the first 18 days. The rainfall during the last week was very great, causing high floods in the brooks and rivers on 31st. The mean temp. of the month was 1°·6 below the average of 25 years, and the lowest in March during that period excepting 1865, 1867 and 1883. All farming operations were delayed owing to the S and severe frosts having been so soon followed by heavy rains.

LEICESTER.—The early part of the month was very cold, the latter part changeable; from February 11th to March 19th the min. on grass was always below 32°.

KILLINGHOLME.—Wintry weather prevailed to the 19th, followed by 10 days of mild spring weather; the close of the month was wet and stormy; T and H on 29th.

HESLEY HALL.—Frost prevailed on the first 18 days, after which the temp. did not once fall as low as 32°.

MANCHESTER.—A cold month, beginning with a heavy S storm ; in the early part there was considerable frost at night, but the weather towards the latter part became warmer, accompanied by R ; S on seven days.

ARNCLIFFE.—A very stormy and snowy month, especially till the 17th; many sheep were lost, and many starved ; temp. fell below 32° in shade on each of the first twenty days, and S lay in the garden till the 25th.

NORTH SHIELDS.—Much S fell during the first three days, the depth on the level being variously estimated at from eighteen inches to two feet ; drifts from 7 ft. to 15 ft. deep were met with all about. S on 12 days, fog on 4 days.

WALES.

HAVERFORDWEST.—The month of March was ushered in with great severity, deep S covering the ground ; from the 5th to the 11th a strong E. gale prevailed with severe frost, which continued without intermission up to the 18th ; the mean temp. of the 18 days being only 29°·2. A sudden thaw then occurred, with S. winds, and vast quantities of R, accompanied by high temp., the soil being so saturated that oat sowing was rendered impossible. Notwithstanding the high mean temp. of the last 13 days, the mean temp. of the month was only 36°·8, 0°·6 lower than that of the severe March of 1883. It was certainly the severest March since 1845.

LLANDUDNO.—The old proverb, "When March comes in like a lion it goes out like a lamb," has not this year been fulfilled, for the month began with a S storm of unexampled severity, and ended with an unusually heavy gale from S.W. There has been nothing approaching it in severity since 1854. The S which began on 1st, fell chiefly on that and the following day, and amounted to about 9 inches. S fell also on 5th, 13th, and 15th, but to no considerable amount. S continued to lie on the ground till 17th, but on that day a thaw set in, and the S soon disappeared, except on the distant hills. There was continuous nightly frost up to 17th, with a mean daily temp. of only 33°·2, and the max. did not reach 42°·0. After the disappearance of the S, the temp. gradually rose to 63° on the 23rd ; this hot wave lasted for three days, and many people believed that summer was about to come upon us prematurely ; even the swallows were apparently taken in, for one was seen flying about the Parade on 25th, but the truth of the proverb, "one swallow does not make the summer," was soon realized, for, as already stated, the month ended with a hurricane and low temp. The mean temp. of the month (40°·1) was 2°·5 below the average ; the mean daily range (11°·2) was very slightly above the average, and the total range (40°·5) was no less than 11°·3 above the average. There was a fair quantity of bright sunshine during the month, viz., 82 hours. Heavy H shower, with L and T, on 31st.

SCOTLAND.

CARGEN.—A very stormy month, the fluctuations in temp. and pressure having been very great. The cold for the first 17 days, accompanied by heavy S storms, was unusually severe, the mean temp. (32°·1) being 8°·6 below the average, while the mean of the last 14 days was 4° above the average ; notwithstanding bright sunshine on several days, the max. in shade only once in the first 17 days reached 42° ; the nearest approach to this extreme cold in March was in 1867, when the mean temp. of the first 17 days was 35°·1. It is very rarely in this part of the country that we have such heavy S storms at any period of the year as occurred during the first half of this month, and the losses to the stock farmers, and the general inconvenience occasioned by the blocking up of roads and railways was considerable. The mean temp. of the month is 3°·0 below the average. The unusually high max. in shade, 65°·8, has been only once exceeded in 26 years, viz., on March 24th, 1871, when 68°·4 was registered, and the unusually low min. of 15°·0 has only once been equalled, viz., on March 15th, 1871. Violent gale on 30th, lasting only two or three hours. H and sleet on 30th and 31st. Duration of sunshine 34 hours below the average. Vegetation and all farm work very backward at the close of the month.

JEDBURGH.—The weather of the month was very cold and ungenial; vegetation was at a standstill and the colour of grass fields like brown paper. Frost prevailed until 17th, after which a change set in; work in fields and gardens was much in arrear at the close and the ground damp and raw. S on 6 days.

KILMORY.—A most backward spring; I never remember before, the month of April coming in without my having seen a single leaf bud open on the sycamore, and the scarlet rhododendron and Andromeda floribunda, which often flower in January, did not do so this year till the middle of March. S on 6 days.

OBAN.—The first part of the month was intensely cold and very dry; light rains and white cloud fog characterised the second half with a short period of very high temp. from 21st to 27th. The sharp gale of the 30th was followed by a splendid display of aurora from nightfall to 10 p.m.; light fine S showers occurred on 3rd, 15th, 17th, 18th, and 31st, but none lay on the ground. H on 23rd.

BRAEMAR.—Very cold up to the 18th, thence to the close of the month unusually mild; very bright aurora on 30th.

ABERDEEN.—Cold weather prevailed during the greater part of the month. Rainfall about half an inch above the average. Brilliant aurora was seen on 26th and 30th and a strong "magnetic storm" occurred on 30th, interrupting telegraphic communication. S showers were very frequent.

LOCHBROOM.—The month will be long remembered for the almost constant and intense frost of the first half; the latter half was fine with the exception of the last two days, which were as wintry as ever; nothing had been sown or planted at the close. Severe S storm on 2nd, S on 30th; aurora on 30th and 31st.

SWANBISTER.—S prevailed from the 1st to the 7th, it was then cold and dry to the 13th, and from the 22nd to the 27th it was very mild; heavy S on 5th and 30th. Gale on 8th; brilliant aurora on 30th.

IRELAND.

BLACKROCK.—The wettest March for 21 years. With the exception of 7th it was fine and cold to 13th, after which it was more or less wet every day. H on 29th and 31st.

DROMORE.—The latter part of the month was very cold, wet, and stormy.

WATERFORD.—The first half of the month was remarkably dry with harsh E. winds; the S that fell on the last day of February remained on the ground in places until the 17th, from which date to the close of the month R was registered each day; total amount of R 1·27 in. above the average. T and L on 23rd and 30th; H on 16th, 29th, and 30th; fog on 20th and 21st. Mean temp. 39·9.

KILLALOE.—Very dry parching weather prevailed till the 18th, with very cold N. and N.E. winds and frost every night; continuous R from the 18th to the close seriously delayed the usual spring operations on the land; during this period the wind was mostly S. and S.E., very high, and at times very stormy, with frequent T and L.

DUBLIN.—The bitterly cold weather which had prevailed during the greater part of January and February held until the 18th of March, when a great change occurred, and from that day until the 29th the mean temp. was as much above as it had previously been below the average, and hence it happens that March, 1886, will not stand out prominently as a cold month in the record of many years. The mean temp. (40°·5) was 2°·2 below the average of 20 years, having, on five occasions during that period, been lower, viz., in 1865, 1867, 1869, 1876, and 1883. At the same time, no such continuous and severe cold in March was noted in any of those 20 years as that which held until the 18th of this month, the first week being, in fact, the coldest period of the winter 1885-6, the mean temp. being only slightly above freezing point. Sleet or S fell on 9 days, H on 8; fog occurred on 4 days; solar halos on 7th and 10th; high winds on 14 days; aurora on 30th and 31st. Mean humidity 79; mean amount of cloud 6·2; prevailing winds S.E., E., and S.W.

EDENFEL.—Not since 1867 has March been marked by weather of such abnormal severity as that which prevailed for the first 18 days of this month; a high, dry, bitter wind, oscillating from N.E. to S.E., continued without even the S that fell elsewhere to save the early vegetation, the mean temp. of the period being 34°·3; the fourth week was the reverse in all respects, soft, humid and balmy, and the month ended with a S.W. gale, with R, H, sleet and S. Vegetation and farm labour extremely backward.

EARTH TEMPERATURE AND WEATHER IN SOUTH AUSTRALIA.

To the Editor of the Meteorological Magazine.

SIR,—At my Torrens Observatory, situated on the plains two miles north-east from Adelaide, I give special attention to the matter of earth temperature, and have records from depths greater than those at other observatories in Australia as far as I am aware. The following statistics will be of interest, and prove by the rise at the lower depths, the abnormal force of the heat waves recently experienced on the Adelaide plains. The earth temperatures are taken as soon as practicable after the ordinary 9 a.m. observations:—

	1885. FEBRUARY 1ST.		1886. FEBRUARY 1ST.
At 1 ft.	80°·4	.....	76°·0
,, 2 ,, ...	79 ·3	.....	78 ·1
,, 4 ,, ...	75 ·5	.....	76 ·2
,, 6 ,, ...	71 ·5	.....	73 ·5
,, 8 ,, ...	69 ·0	.....	71 ·9
,,10 ,, ...	68 ·1	.....	71 ·2
,,12 ,, ...	66 ·5	.....	68 ·2

During January, 1885, the air maxima exceeded 95°, but 100° was not reached. During January, 1886, maxima of 100·6, 105·2 and 111·6 were registered in my enlarged Stevenson's screen; the latter value occuring on the 4th. At 3 p.m. on that day the dry bulb read 109·7, wet 75·9, giving the enormous difference of 33·8, and a relative humidity by Guyot's formula of only 15. At 3 a.m. on the 3rd inst. my electric hygrometer read—dry bulb 49·6, wet 48·6, giving 93 as a per-centage of humidity. Can we have a better instance of the extraordinary vicissitudes of the South Australian climate? I employ two Stevenson's screens—the small English pattern, and an enlarged form with double roof to suit Australian conditions. Of course I have duplicate sets of instruments. I find the two screens work admirably together, the difference between them averaging but a few tenths, and there is no case of internal heating.

CLEMENT L. WRAGGE.

Torrens Observatory, Adelaide, S. Australia, February 8th, 1886.

P.S.—The rules of the Royal Meteorological Society are strictly in force.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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SWEDISH WEATHER PROVERBS.

Samling af bemärkelsedagar, tecken, märken, ordspråk och skrock rörande väderlaken. Af H. HILDEBRAND HILDEBRANDSSON. (Excerpt from "Antiqvarisk tidskrift för Sverige.") 8vo, 118 pages.

A MAGNIFICENT collection of Swedish weather proverbs (about 900), duly classified, and with remarks, notes, and explanations by Dr. Hildebrandsson. Of course the series includes many which are common to all Europe, if we may not say to all the world; but it includes many which we have never seen before, and doubtless many others the full force of which our knowledge of Swedish is insufficient to reveal. We may quote one which at any rate would not be bad for London, and which may perhaps be regarded as the Swedish equivalent of our St. Swithin.

> Juli.—Den 19—26:te ar *fruntimmers*—eller *flickveckan*, då regnar vanligen.
> July.—The 19th to the 26th, or the women's week which is generally rainy.

Dr. Hildebrandsson in another part of the work refers to this proverb, and explains that it is called women's week, because in the Swedish calendar, six out of the seven saints are women, and although he found that the rainfall of 12th to 19th, 19th to 26th, and 26th to August 2nd, was nearly identical, he admits that it is almost the wettest week in the year.

At the end of the work Dr. Hildebrandsson gives in French a sort of abstract and review of the whole.

"From the most remote antiquity meteorological phenomena have been observed, and attempts made to predict the weather, but as regards the latter three different methods have prevailed, which may be designated, mythological, astrological, and scientific. In the first period, atmospheric changes, and, indeed, all natural phenomena, were attributed to the influence of supernatural spirits and powers; in the second, the weather, and all the events of life, were supposed to be ruled by planetary positions; and in the third we try to de-

termine the laws which regulate natural phenomena, and therefrom future probabilities.

"Weather proverbs are still popular, and the collection in this work contains traces of all three periods. We find a certain, if small, proportion of popular superstitions. There are traces of astrology in the pretended relation between the weather and the heavenly bodies, especially the moon, and lastly there is a collection of observations.

"We find also traces of all three periods in many of the dates. It has been shown in Sweden and in other countries, Italy for example, that certain days celebrated as fêtes in Pagan times have continued to be so after the introduction of Christianity. The saint has displaced the god or the hero, but in popular estimation has not infrequently retained his good or bad characteristics. But very often these dates are really fixed upon solid foundation, as they correspond to periods when, if certain weather occurs, it will exercise an important influence upon the harvest."

The author next gives a list of the principal sources from which he has compiled the collection, and then proceeds with remarks upon the several groups.

"Group I. relates to the days of the week; there are very few of them, and they are self-evidently of no importance."

"Groups II. to XVII. relates to months and seasons; their chief foundation is on the fact that *average temperature is that best suited for agriculture*. For instance, the winter ought to be uniformly cold, and the soil covered with snow; spring ought to be cold and rainy, so that a too precocious warmth may not accelerate vegetation before risks of night frosts are passed, and so that the soil may receive the needed moisture. Summer ought to be hot, especially during harvest. Finally, autumn frosts should not occur till all the crops are gathered, and snow should not fall too early, because early winters are rarely long ones."

"Groups XVIII. to XXX. relate to special days. And we may in the first place dismiss all those based on the *moveable* festivals of the Church, as self-evidently absurd, and besides that they are often contradictory; for instance rain on Whit Sunday is said to poison the soil, and it is also said to produce plenty at the following Christmas."

Dr. Hildebrandsson then discusses several of the proverbs, and shows their reasonableness; in fact, this part of the work closely resembles Dr. Clouston's "*Explanations of the Popular Weather Prognostics of Scotland.*"

"Groups XXXI. to XXXIII. consist of proverbs based upon the sun, moon, and stars. It is useless to consider the large number of these which relate to the motions and phases of these bodies, for as they do not affect the sun they are entirely without foundation. Science has put it beyond all doubt that lunar positions and phases have not the slightest influence upon the weather."

Dr. Hildebrandsson says nothing about Group XXXIV., which

deals with proverbs as to thunder, but we may quote one which is new to us :—

Åska i vinterqvartal,
Bringar köld utan tal,

and which, we suppose, may be rendered—

Thunder in the winter quarter,
Brings frosts without number.

"Group XXXV. deals with optical phenomena, and the indications of the clouds and atmosphere, and contains a great many proverbs which are perfectly in accordance with modern meteorology. The study of cyclones and anti-cyclones has shown that in the centre of a cyclone the air has an ascensional movement, and carries up with it vapour, which is condensed into clouds and rain especially on the front or eastern edge of the depression. At a great height this air stretches away from the centre like a fan, and always towards the front, and stretches over the anti-cyclone for sometimes hundreds of miles.* Near the minimum this covering of cirrus is very dense and grey, further off it becomes thin and striated, and finally it becomes mere filaments, like the faintest touches of white on the azure of the sky. Suppose now that we are in a region of fine weather, with a high barometer and a sky either cloudless or partly covered with those low grey clouds which rarely yield any rain. If the sky be clear, we shall have the stars scintillating brightly, the milky way very distinct, the moon's horns sharply defined, and all the details of our satellite clearly visible. If now a minimum with bad weather approaches, generally from the west, cirrus will begin to show itself. If it be night, the moon, stars, and milky way will seem to have a gauzy veil drawn across them, as the result of vapour condensation in the upper regions. As the cyclone approaches, this veil becomes thicker, like a pale grey felt on the side whence it is coming, generally the west. Then we have solar and lunar halos, mock suns and mock moons. Bad weather comes nearer, and the lower rain clouds are formed. As soon as the centre has passed to the east of us, the clouds break up, the rain falls in short, heavy showers, cirrus reappears, but is more scattered, and the clouds go off towards the east. All these indications are perfectly safe, and they often indicate weather one or two days in advance, for so vast is this cirrus veil that sometimes it is visible at Upsala while the centre is over Scotland."

"From what has just been said, it will be evident that it is safe to predict bad weather when the sun sets red, and as the Swedes say, 'makes its bed in the clouds,' and when it rises clear and sharp, but soon enters clouds coming from the west. Similarly, a rainbow in the morning indicates rain in the west, that is to say, generally rain which is approaching; while a rainbow in the evening indicates rain in the east, that is to say, generally rain which is passing away."

* These facts have been proved by the researches of Dr. Hildebrandsson and Rev. Clement Ley.

"As regards aurora borealis, it seems evident that those grand displays which are seen over half the hemisphere at once, can have no direct connection with local weather. It may be otherwise with smaller, local displays, but I do not know that it has ever been proved."

After a few unimportant remarks on Groups XXXVI. to XL., Dr. Hildebrandsson sums up in the following paragraphs:—

"1. Every pretended connection between the weather and the days of the week, saints' days, the position of the heavenly bodies, and the phases of the moon is an absurdity."

"2. In the present state of science it is impossible to make any prediction as to the temperature of a month or of a season, therefore critical days and other signs relating thereto are utterly valueless."

"3. Vegetation and the harvest are generally favoured when the seasons have their average temperature. This is really what most weather proverbs teach."

"4. There exists a great number of proverbs relative to the weather, which may be expected to occur within a very short time, and many of these are very trustworthy."

This is slashing criticism, and the first impression which it conveys to our mind is one of wonder at Dr. Hildebrandsson allowing the Antiquarian Society to be at the cost of printing his paper of 118 pages if much of the matter is, as he states in clause No. 1 and No. 2, either absurd or valueless.

HEAVY FLOOD IN THE UNITED STATES, MARCH 28–31, 1886.

Mr. J. E. Clark has been kind enough to send us a copy of the *Atlanta Constitution*, published at Atlanta, Georgia, on March 31st. Making full allowance for the special style of articles prepared for the press in America, there yet remains evidence that the flood of the end of last March was by no means an ordinary one. We do not find the details of the fall of rain for every day, but at Atlanta the fall was, 10 p.m. 29th to 6 a.m. 30th, ·09 in.; 6 a.m. to 2 p.m., ·19 in.; 2 p.m. to 10 p.m., 1·95 in.; total from 10 p.m. 28th to 10 p.m. 31st, (3 days) 9·64 in. At Taladega, Alabama, the total reached 9 in. in two days. The repair of street paving alone was put at £2,000, the sewers burst in many places, and much damage was done by the flooding of basements. Many of the railways were broken, and telegraphic communication was shut off. At West Point, Georgia, the water was 5 ft. deep in the streets, and a steamer went along them. The towns where the damage seems to have been greatest, Athens, Montgomery, Monroe, &c., are mostly in Central Alabama, or Northern Georgia.

REVIEWS.

The Rosarian's Year Book, 1886. Edited by the Rev. H. HONYWOOD D'OMBRAIN, Hon. Sec. National Rose Society. Sq. 8vo, 87 pages. London: Bemrose, 1886.

THIS chattily-written work has now a position so thoroughly established that it needs no recommendation from us, but in case any lover of the rose does not yet know of it, we devote a line or two to mentioning it, and especially the very careful paper by Mr. Mawley on "The Weather of the past Rose Year."

Lecture on the Occurrence of Droughts, their causes, and the means whereby their effects might be mitigated, modified, or relieved. Delivered at the Town Hall, Kingston, under the auspices of the Jamaica Society of Agriculture and Commerce . . . . . by D. MORRIS, M.A., F.L.S., Director of Public Gardens and Plantations, Jamaica. 8vo., 30 pages. Jamaica: *Colonial Standard* Office, 1885.

MR. MORRIS explains that his lecture arose from the drought which had prevailed in Jamaica during 1880, 1881, 1882, 1883, and 1884, in which the rainfall for the whole island instead of being, as used to be the case, about 70 inches, had been respectively 55, 69, 58, 48, and 50 inches, or an average yearly deficiency of one-fifth. He devotes some attention to, and naturally speaks highly of, the good work done by Mr. Maxwell Hall, in organizing and publishing the observations made in Jamaica. The author points out that as there are no actual data respecting the rainfall of Jamaica at remote periods, the question whether the rainfall is steadily decreasing cannot be properly answered, but he gives extracts from Sir Hans Sloane's publications respecting 1687–88, and quotes other authorities tending to indicate a considerable decrease.

The second part of the lecture much reminds one of the late G. P. Marsh's excellent work *Man and Nature*, and is a really valuable contribution to the literature respecting the influence of forests on rainfall, for Mr. Morris has hunted up reports and blue books, and Foreign and English journals, and thus brought together much valuable evidence. Perhaps the following is the best worth quoting, because of the standing of the speaker:—

Sir Richard Temple speaking on this subject at a recent meeting of the Society of Arts remarked:—"We had before our eyes the most frequent examples of the consequences of deforesting. What was the cause of Palestine, Syria, Asia Minor, and parts of Mesopotamia, being so utterly barren and destitute, compared with what they were in ancient times? People attributed it to invasions and revolutions, but it was owing far more to deforesting.

"Many of the beautiful hills which, long before the Christian era were well clad, are now utterly bare, and thus the climate has become affected, the rivers and harbours are silted up, as was shown at Ephesus and the mouth of the river near Tarsus. Again, the same thing was the cause of the fearful famines in China; for the art of forestry had there been long extinct. He would not stay

to speak in detail of the Indian famines, but having served through them, he could say that *one* of the causes, probably the *main* cause of the droughts, was the destruction of forests in past times."

We should have omitted the last paragraph on page 20, as we believe that the differences found were due rather to mechanical than to hygrometrical causes, but the chapter is so strong that the removal of this paragraph will still leave the arguments amply supported.

In conclusion, the author considers that the rainfall has become smaller and less regular, that this has been synchronous with careless destruction of the woods, especially by forest fires, and that legislation against reckless firing, and excessive clearing, and in favour of reforesting, is indispensable.

Istruzioni per le Osservazioni Meteorologiche e per l'Altimetria Barometrica del. P. L. DENZA. Two parts sm. 8vo, 315 and 143 pages. Turin : Collegio Artiganelli, 1882-83.

THESE two volumes have so long been waiting for notice that it seems almost too late to accord it. However, they are so good that it is ungracious not to say so.

But though the books themselves are as a whole very good, there are some parts of Italian practice which we shall continue to condemn as long as we are able to write. We do not like the "finestra esposta al Nord," and do not consider that Italian temperature records will be comparable with those of other countries until it is abandoned. If a Russian pleads for the protection of a house when making his observations, human nature compels one to sympathize with him ; but why an Italian is not to go out into a garden, puzzles us completely.

Our great difficulty is, however, with the rain gauges. Here is Padre Denza, one of the foremost meteorologists, not only in Italy, but deservedly respected throughout Europe, giving on page 173 of the Instructions prepared for the powerful *Associazione Meteorologica Italiana*, his design for a meteorological station, and he has put the rain gauge in a position where its records will be not only wrong, but incapable of being made right by any kind of correction. It is on the top of the battlement at the angle of a tower about 12 ft. square, and 35 or 40 ft. high. This position closely resembles, but is worse than, that of the 24 in. gauges on the top of Mr. Dines's tower (Frontispiece to *British Rainfall*, 1877), and, therefore, will collect about *from ten to twenty per cent.* less rain than actually reaches the ground.

We are glad to see that on an earlier page (93), Padre Denza explains how the gauge could be fixed to a dwarf pillar so that it might remain only 3 ft. above the ground, but he immediately follows it by pointing out how much more handy it is to fix the gauge on a terrace and let the water run down a lead pipe.

We do not remember any set of instructions in which so much care has been taken to make every detail perfectly clear, and the engravings are mostly very good—even the Fortin barometer, which for some unaccountable reason is turned upside down, is clearer than any engraving of that instrument which we remember. The instructions for computing heights and for barometric reductions are very carefully worked out, and the second volume, that of Tables, contains several useful ones not generally given.

L'Ouragan de Juin, 1885, *dans le Golfe d'Aden.* Par le VICE-AMIRAL G. CLOUÉ. 8vo., 68 pages and one chart. Paris, Baudoin & Cie. 1886.

A CAREFUL collection of the reports of vessels which were unfortunate enough to be at the Southern extremity of the Red Sea when the rare and very violent cyclone of June, 1885, passed across. Reference to the same storm will be found on p. 56 of this number, as the captain of one of the vessels sent a full account to the Royal Meteorological Society. That, however, stated only the facts as observed on one ship—Admiral Cloué has collected those from between thirty and forty vessels.

The Naturalist's Diary: a Day-book of Meteorology, Phenology, and Rural Biology. Arranged and edited by C. ROBERTS, F.R.C.S., &c. 8vo, xlviii.—366 pages, 1 coloured map. London: Swan, Sonnenschein & Co. 1886.

WE believe that we saw an advertisement of this work notifying half-a-crown as its price. Cost does not concern reviewers, but when it is exceptional there seems scant justice in ignoring it, and in this case it is so low as to prove one or other of the following alternatives: (1) Author and publisher must have agreed to abandon all idea of profit, and be aiming solely at the development of a taste for phenological work, or (2) Observers and recorders of natural history details must be a much larger body than we imagined. Whatever be the explanation, there is no doubt about the book being very cheap.

We have been wondering what Gilbert White would have said could a friend have sent him a copy, so handy and so tempting. His delight would have been a treat to see, but he would have had some pills to swallow. He was a delightful gossiper, but some of the arrangements which in the present advanced state of the work he began are necessary and time-saving, would have been a worry to him—*e.g.*, would not he have preferred "March 30th" to "89th" (day of year) and "May 7th" to "127th" yet the recording of dates of flowering, &c., by the day of the year is an immense improvement over the day of the month. However, no one need make a trouble of that, for this diary gives both, and with a superfluity of desire to be useful, gives also a compact table for converting one into the other.

There are a few trifling errors, chiefly in meteorological matters, but they are unimportant—*e.g.*, on p. vi. of the Preface the author recommends a mode of calculation which on p. v. he seems to have forgotten to adopt; on page xvii. he gives the barometric details as if they were degrees (29°·719) instead of inches; and on page xxix. he falls into the very common error of mis-matching the work of the Meteorological Office and that of the Royal Meteorological Society. All these are, however, small matters, and lovers of the country, and of its plants, trees, insects, birds and fishes, will do well to procure a copy of the "Naturalist's Diary," both on account of the information it contains and of the conveniences it offers for any one to so record the facts he may himself notice, as to be able in any subsequent year to turn to them in half a minute.

ROYAL METEOROLOGICAL SOCIETY.

The usual Monthly Meeting of this Society was held on Wednesday evening, April 21st, at the Institution of Civil Engineers, 25, Great George Street, Westminster, Mr. W. Ellis, F.R.A.S., President, in the Chair.

Mr. L. J. Petre and Mr. G. B. Wetherall were balloted for and duly elected Fellows of the Society.

The following papers were read:—

(1.) "The Climate of Killarney," by the Ven. Archdeacon Wynne, M.A., F.R.Met.Soc. The climate is determined partly by its geographical position, and it has the benefit of proximity to the South-west coast with all the modifying influence of the Gulf Stream. The temperature, however, is locally modified, and a decided difference is found to exist between that of Valencia and that of Killarney. The author shows that Killarney is colder than many other places in Ireland, and this he attributes to the fact that it is in a large irregular basin surrounded by mountain ranges for about one third, and by hilly plains elevated some hundreds of feet above the lakes on most of the remaining two-thirds of the circle.

(2.) "Note on the Probability of Weather Sequence," by Lieut.-Col. C. K. Brooke, F.R.Met.Soc.

(3.) "Account of the Cyclone of June 3rd, 1885, in the Arabian Sea," by Capt. M. T. Moss. The author who was in command of the "S.S. Inchulva," while on a passage to Bombay, had, when near Aden, the misfortune to encounter a most furious storm on the above date. This storm was exceedingly severe, and was accompanied by an immense wave which caused several fine steamers to founder.

(4.) "Results of Solar Radiation Observations in the neighbourhood of Birmingham, 1875–1884," by Rupert T. Smith, F.R.Met. Soc.

(5.) "Results of Meteorological Observations made in the Malay Native State of Selangor during 1884," by A. W. Sinclair, L.R.C.P. These observations were taken at four stations, viz., Kwala Lumpor, Klang, Kajang and Kwala Langat. The mean temperature of the district is about 80° and the rainfall about 90 inches.

PERIODICAL RECURRENCE OF WARM SUMMERS.

To the Editor of the Meteorological Magazine.

SIR,—With reference to Mr. Brumham's letter in the last number of the *Meteorological Magazine*, I beg to draw attention to the very frequent recurrence of excessive heat in this country after an interval of 17 years.

The following years of this century are notable for warm summers, viz. :—1802, 1808*, 1818*, 1825, 1835*, 1842*, 1852, 1856, 1857*, and 1859*, which heat returned, in each case, 17 years after, viz. :—in the years 1819, 1825, 1835*, 1842*, 1852, 1859*, 1869*, 1873, 1874, and 1876*.

In a few instances, when the hot summer did not return at the expiration of 17 years, it returned at the end of 34 years; thus the warm summers of 1800*, 1822, 1831*, 1834*, and 1847* had their recurrence respectively in 1834*, 1856, 1865*, 1868*, and 1881.

The asterisk signifies that the summer was of long duration.

I am, Sir, yours truly, GEO. T. GWILLIAM.

Bayswater, May 1st, 1886.

BAROMETRIC WELLS.

To the Editor of the Meteorological Magazine.

SIR,– On looking over the summary of the history of the barometers lately exhibited by the Royal Meteorological Society, which appeared in your last issue, it struck me that the following translation of a notice which appeared in the *Bollettino mensile dell' Osservatorio Meteorologico del R. Istituto nautico di Riposto*, for February last, might interest you, if you had not already seen it :—

BAROMETRIC WELLS.

"In the village of Meyrin (Canton of Geneva, Switzerland), there are some disused wells which serve as barometers to the population. These wells are of considerable depth, and are hermetically closed. An orifice of about an inch in diameter is made in the cover of the well and puts the internal in communication with the external air. When the pressure diminishes, the internal air escapes and blows a whistle in connection with the orifice, and in this way notice of the possible approach of bad weather is given to the inhabitants.

"If, on the contrary, the pressure increases, a different sound is produced by the entry of the air into the well, and the population is made aware of the probability of fine weather."—Yours faithfully,

Meteorological Office, May, 1886. J. S. HARDING, Jun.

HEAVY RAIN AT CAPE TOWN, MARCH 8TH, 1886.

An exceptionally heavy rain fell over Cape Town, Cape of Good Hope, on March 8th–9th, washing up the roadway in several streets, bursting a sewer and flooding many basements. The rain fell chiefly between 8·30 and 10 p.m. on 8th; at Sea Point it was 1½ in.; in Kloof Road, 3·00 in.; at the Town House, 2·39 in.; at the South African College, 2·84 in.; at the Royal Observatory, 1·79 in.; and at Wynberg, 2·03 in. (in three quarters of an hour.)

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCT., 1885.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	60·9	3	33·4	12	53·1	41·1	40·7	82	104·8	25·8	3·73	17	6·6
Malta	88·4	14	55·7	13	76·4	63·7	59·8	76	137·1	49·5	3·18	8	4·4
Cape of Good Hope	97·3	26	43·0	8	73·6	54·1	...	...	...	...	1·83	9	4·6
Mauritius	79·2	24	61·3		76·5	66·4	60·4	71	130·8	48·8	1·57	13	5·5
Calcutta	90·0	6	64·7	29*b*	87·0	·9	74·9	84	155·1	55·8	5·29	8	4·1
Bombay	90·8	16	73·1	3	87·8	76·9	74·9	78	145·3	60·7	3·54	8	4·0
Ceylon, Colombo	87·2	12	72·2	6	84·9	74·4	72·0	80	148·8	64·0	16·12	30	7·5
Melbourne	96·1	30	36·5	4	67·3	49·1	47·3	69	145·2	28·4	1·99	8	6·3
Adelaide	92·7	27	40·5	12	74·4	54·4	48·2	55	150·1	31·0	1·11	11	5·9
Wellington	68·9	31	40·0	10*c*	60·8	47·6	49·7	84	138·0	34·0	5·02	14	3·5
Auckland	66·0	25	43·0	4	61·3	50·5	47·4	74	138·0	35·0	2·27	16	7·0
Jamaica, Kingston	90·5	5, 15	70·3	21*d*	88·8	73·0	72·3	78	...	...	·62	...	4·6
Barbados	85·0	17*a*	71·0	3*e*	83·0	73·0	76·6	87	146·0	...	8·22	14	6·0
Toronto	70·2	1	23·4	31	52·8	38·4	41·2	81	...	18·2	3·81	14	6·6
New Brunswick, Fredericton	70·3	4	22·9	13	55·7	36·6	40·1	79	...	...	4·08	8	5·3
Manitoba, Winnipeg	68·8	1	11·8	26	49·1	27·1	31·3	77	...	...	·59	10	6·1
British Columbia, Victoria	67·0	5	33·0	11	59·1	41·5	...	...	...	...	2·73	9	...

(*a*) And 18. (*b*) And 31. (*c*) And 13, 15. (*d*) And 23, 24. (*e*) And 5, 13.

REMARKS, OCTOBER, 1885.

MALTA.—Mean temp. 68°·7; mean hourly velocity of wind 9·2 miles; average velocity 20 miles per hour, from 8 a.m. on the 14th to 8 a.m. on the 15th, and from noon to 4 p.m. on the 25th and 30th; the max. temp. on the 14th was reached after 8 p.m.; sea temp. fell from 78° to 73°; TSS on 7th, 10th, and 25th. J. SCOLES.

Mauritius.—Rainfall ·02 in. above, and mean temp. 1°·0 below average; mean hourly velocity of wind 11·3 miles, extremes 28·1 miles on 12th and 1·7 mile on 7th, prevailing direction E.S.E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·2, of dew point 1°·0, pressure 166 in., and mean amount of cloud ·3 above their respective averages; rainfall ·89 in., and mean humidity 1, below their averages; prevailing winds S. and S.W., strong on 4 days from N. and W.; heavy dew on 3 days, hoar frost on 2; H on 11th, T and L on 21st, T on 31st. R. L. J. ELLERY, F.R.S.

Adelaide.—The mean pressure and the mean temp. (64°·4) were far higher than the corresponding figures for the previous 28 years, the former being ·126 in. and the latter 2°·5 above the average; the mean amount of cloud was 10 per cent. above, but the rainfall nearly ·70 in. below the average. W. E. COOKE.

Wellington.—From 1st to 5th squally and showery; 6th to 12th generally fine; showery from 13th to 16th; fine from 17th to 23rd, with strong wind at times; from night of 23rd to 25th showery; the remainder of the month fine. Prevailing wind N.W., frequently stormy. H on 1st. Mean temp. (54°·2) 0°·5, rainfall ·33 in., and pressure ·068 in. above their respective averages. R. B. GORE.

Auckland.—A cold, cloudy, and windy month; rainfall and mean temp. below the average, pressure above it. T. F. CHEESEMAN.

JAMAICA.—The rainfall of the island was below the average, especially in the N.E. and S. divisions; a severe shock of earthquake on the morning of the 2nd was reported from several stations. MAXWELL HALL.

BARBADOS.—The mean temp. (77°·2) was nearly the average; rainfall 14 per cent. below the average; pressure unsteady; prevailing wind N.E., mean hourly velocity 7·3 miles, 7 per cent. above the average, extremes 13·4 miles and 3·7 miles; 8 days were cloudy and rainy; TSS on 7th, 10th, and 14th. R. BOWIE WALCOTT.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOV., 1885.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0–10
England, London	58·7	30	28·3	17	48·5	38·6	40·2	89	82·2	17·8	3·31	18	7·5
Malta	76·9	2	51·2	7	68·3	57·0	55·0	83	126·0	46·0	3·80	9	4·8
Cape of Good Hope	85·0	27	50·0	27	76·4	55·8	...	...	...	...	1·66	5	3·5
Mauritius	84·0	29	60·1	7	80·3	68·4	63·8	73	137·2	47·6	1·59	10	5·4
Calcutta	84·5	6	57·1	27	81·3	64·7	64·2	77	145·9	45·6	·06	2	3·3
Bombay	90·8	4	69·0	25	87·8	74·3	68·4	67	148·2	56·4	·00	0	1·2
Ceylon, Colombo	89·4	27	71·2	26	85·9	74·0	71·8	77	148·0	63·0	12·53	22	6·1
Melbourne	90·5	25	42·1	11	69·4	51·5	48·3	67	146·2	35·1	3·54	11	6·2
Adelaide	94·7	3	45·4	7	77·5	55·5	45·8	46	154·7	35·7	·04	4	4·3
Wellington	73·0	28	43·0	14	62·8	49·6	51·6	84	146·0	39·0	2·22	9	3·6
Auckland	73·0	29*a*	45·0	5	65·5	52·9	49·7	71	141·0	33·0	2·82	13	6·5
Jamaica, Kingston	95·2	6	68·8	11	88·9	73·4	71·7	77	...	...	·66	...	5·5
Barbados	84·0	21	70·0	11	82·0	73·0	74·5	85	143·0	...	7·67	20	5·0
Toronto	61·8	12	20·6	28	43·9	32·4	34·2	81	...	15·4	2·15	18	8·5
New Brunswick, Fredericton	52·3		5·7	29	39·7	25·7	27·1	79	...	...	4·10	10	5·6
Manitoba, Winnipeg	38·3	27	5·8	15	31·2	18·8	23·8	88	...	...	·80	5	7·9
British Columbia, Victoria	57·0	1	31·0	10	51·6	40·8	...	...	...	...	3·47	19	..

a And 30

REMARKS, NOVEMBER, 1885.

MALTA.—Mean temp. 61°·3; mean hourly velocity of wind 9·7 miles; sea temp. fell from 73°·0 to 66°·0. TSS on 4th, 7th, 21st and 23rd. J. SCOLES.

Mauritius.—Rainfall ·17 in. above, and mean temp. 0°·7 below average; mean hourly velocity of wind 10·3 miles; extremes 28·0 miles on 1st, and 1·7 miles on 22nd; prevailing direction E.S.E. C. MELDRUM, F.R.S.

COLOMBO.—TSS on 10 days. F. C. H. CLARKE, Lt.-Col. R.A.

Melbourne.—Rainfall 1·08 in., pressure ·117 in., and mean amount of cloud ·2 above the average; mean temp. of air 0°·3, and of dew point 0°·1 below the average; humidity same as average. Prevailing winds S. and S.W., strong on eight days. TSS on 4th and 25th; L on 10th; H on 10th and 28th; heavy dew on 3rd and 14th. R. L. J. ELLERY, F.R.S.

Adelaide.—The driest November ever experienced here. Rainfall nearly an inch below the average; pressure ·133 in. above the average of 29 years; and considerably above any prior record. Mean temp. about the average. W. E. COOKE.

Wellington.—Heavy R fell on 2nd and 3rd, then fine weather prevailed till the middle of the month, when it was showery; the end was fine and bright; prevailing wind N.W. Rainfall 2·05 in., and mean temp. 0°·5 below the average; pressure ·089 in. above average. T and H on 15th. R. B. GORE.

Auckland.—The commencement and middle of the month were rather cold and windy, with occasional showery days, but no heavy R; the end of the month was fine and warm, with light N. and N.E. winds; pressure above, and mean temp. and rainfall both slightly below the average. T. F. CHEESEMAN.

BARBADOS.—Rainfall 5 per cent. below, and mean temp. (77°·2) 1°·0 below the average; pressure steady; wind N.E. on 27 days, S.E. on 3 days, mean hourly velocity 7·3 miles, 10 per cent. below the average; extremes 14·1 miles and 3·2 miles; T and L on five days; eight days were overcast. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	2·16	XI.	Castle Malgwyn	2·76
,,	Margate, Birchington...	1·16	,,	Rhayader, Nantgwillt..	3·26
,,	Littlehampton	1·82	,,	Carno, Tybrith	2·45
,,	Hailsham	...	,,	Corwen, Rhug	2·73
,,	I. of W., St. Lawrence.	1·83	,,	Port Madoc	2·61
,,	Alton, Ashdell.....	2·23	,,	I. of Man, Douglas	2·34
III.	Winslow, Addington ...	2·20	XII.	Stoneykirk, Ardwell Ho.	1·41
,,	Oxford, Magdalen Col...	2·13	,,	Melrose, Abbey Gate...	1·62
,,	Northampton	1·77	XIII.	N. Esk Res. [Penicuick]	1·70
,,	Cambridge, Beech Ho...	1·02	XIV.	Ballantrae, Glendrishaig	1·55
,,	Wisbech, Bank House..	1·45	,,	Glasgow, Queen's Park.	1·38
IV.	Southend	1·62	XV.	Islay, Gruinart School..	2·13
,,	Harlow, Sheering	1·65	XVI.	St. Andrews, Pilmour Cot	1·83
,,	Rendlesham Hall	1·05	,,	Balquhidder, Stronvar..	5·86
,,	Diss	1·47	,,	Dunkeld, Inver Braan..	2·17
,,	Swaffham	1·76	,,	Dalnaspidal H.R.S. ...	4·38
V.	Salisbury, Alderbury...	1·79	XVII.	Keith H.R.S.	1·19
,,	Warminster	3·93	,,	Forres H.R.S.	1·10
,,	Calne, Compton Bassett	2·42	XVIII.	Strome Ferry H.R.S....	4·45
,,	Ashburton, Holne Vic..	3·37	,,	Tain, Springfield.....	·98
,,	Holsworthy, Clawton...	2·40	,,	Loch Shiel, Glenaladale	6·51
,,	Hatherleigh, Winsford.	2·32	,,	S. Uist. Ardkenneth ...	2·39
,,	Lynmouth, Glenthorne.	2·80	,,	Invergarry	4·99
,,	Probus, Lamellyn	2·40	XIX.	Lairg H.R.S.	...
,,	Wincanton, Stowell Rec.	2·31	,,	Forsinard H.R.S.	1·87
,,	Taunton.....	2·97	,,	Watten H.R.S.	1·82
,,	Wells, Westbury.....	2·77	XX.	Dunmanway, Coolkelure	4·30
VI.	Bristol, Clifton	2·35	,,	Fermoy, Gas Works ...	2·26
,,	Ross	2·72	,,	Tralee, Castlemorris ...	3·11
,,	Wem, Sansaw Hall.....	·84	,,	Tipperary, Henry Street	2·39
,,	Cheadle, The Heath Ho.	1·79	,,	Newcastle West	...
,,	Worcester, Diglis Lock	2·05	,,	Miltown Malbay.....	2·40
,,	Coventry, Coundon	1·86	XXI.	Gorey, Courtown House	2·07
VII.	Melton, Coston	1·47	,,	Navan, Balrath	2·16
,,	Ketton Hall [Stamford]	1·45	,,	Mullingar, Belvedere...	1·97
,,	Horncastle, Bucknall ...	1·32	,,	Athlone, Twyford	2·33
,,	Mansfield, St. John's St.	2·22	XXII.	Galway, Queen's Col....	2·03
VIII.	Macclesfield, The Park.	1·80	,,	Clifden, Kylemore	4·03
,,	Walton-on-the-Hill.....	1·67	,,	Crossmolina, Enniscoe..	2·56
,,	Lancaster, South Road.	2·88	,,	Collooney, Markree Obs.	2·11
,,	Broughton-in-Furness ..	3·12	,,	Carrick-on-Shannon ...	1·62
IX.	Wakefield, Stanley Vic.	1·66	XXIII.	Rockcorry.....	1·92
,,	Ripon, Mickley	2·92	,,	Warrenpoint	2·33
,,	Scarborough.....	2·46	,,	Newtownards	...
,,	East Layton [Darlington]	1·89	,,	Belfast, New Barnsley .	1·70
,,	Middleton, Mickleton ..	3·14	,,	Cushendun	2·46
X.	Haltwhistle, Unthank..	2·43	,,	Bushmills	...
,,	Shap, Copy Hill	4·87	,,	Stewartstown	1·19
XI.	Llanfrechfa Grange	2·61	,,	Buncrana	...
,,	Llandovery	2·95			

APRIL, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max Deg.	Max Date	Min Deg.	Min Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·22	— ·80	·30	7	15	69·6	24	32·2	11*a*	0	6
II.		Maidstone (Hunton Court)...	1·50	— ·35	·31	7	12	...	...	...	...	...	...
,,		Strathfield Turgiss	1·37	— ·54	·44	7	15	72·5	29	28·3	13	4	10
III.		Hitchin	1·62	— ·33	·50	7	14	65·0	28	26·0	30	4	...
,,		Banbury	2·40	+ ·39	·45	7	18	67·0	24	28·0	12	4	...
IV.		Bury St. Edmunds (Culford)	1·15	— ·64	·31	10	12	71·0	28	24·0	30	6	...
,,		Norwich (Cossey)	1·28	— ·58	·41	7	12	66·5	28	31·0	27	2	6
V.		Weymouth(LangtonHerring)	1·43	...	·51	7	10	67·0	28	32·0	12*b*	:	...
,,		Barnstaple.....	3·19	+ ·81	·76	10	17	75·0	28	32·0	12	1	...
,,		Bodmin	3·40	+ ·07	1·42	28	19	68·0	27	4·0	12		10
VI.		Stroud (Upfield)	2·22	— ·23	·44	24	19	71·0	27	9·0	11	1	...
,,		ChurchStretton(Woolstaston)	1·57	— ·75	·27	7	16	69·5	27	29·0	30	5	10
,,		Tenbury (Orleton)	2·24	+ ·07	·39	2	17	69·7	27	26·0	12	4	9
VII.		Leicester	2·14	...	·40	2	20	69·6	27	30·0	11	3	8
,,		Boston	1·42	— ·47	·29	10	11	68·0	23	32·0	10	1	...
,,		Grimsby (Killingholme).....	1·81	+ ·05	·40	17	15	59·0	2	33·0	30	0	...
,,		Hesley Hall [Tickhill].....	1·74	...	·34	17	17	70·0	27	29·0	30	4	...
VIII.		Manchester (Ardwick).....	1·27	— ·76	·25	7	15	70·0	27	30·0	11	2	...
IX.		Wetherby (Ribston Hall) ...	2·41	— ·10	·52	29	13	...	...	...	...	...	...
,,		Skipton (Arncliffe)	4·70	+ 1·64	·78	5	20	70·0	27	27·0	29	...	...
X.		North Shields	1·58	— ·42	·43	18	17	67·0	27	27·0	30	3	3
,,		Borrowdale (Seathwaite).....	6 82	+ 1·88	1·26	5	15	70·5	27	27·2	30	3	...
XI.	WALES.	Cardiff (Ely).....	3·00	+ ·66	·77	7	17	...	...	...	...	...	...
,,		Haverfordwest	2·58	— ·24	·41	7*c*	16	70·0	28	27·0	11	4	14
,,		Plinlimmon (Cwmsymlog) ...	2·11	...	·36	2	15	...	...	...	...	...	...
,,		Llandudno.....	1·67	— ·21	·30	23	14	67·0	27	32·5	30	0	...
XII.		Cargen [Dumfries]	2·17	— ·12	·39	2	11	69·0	27	25·2	30	3	...
,,		Jedburgh (Sunnyside)	1·65	— ·05	·25	27	14	69·0	27	29·0	29	4	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	25·0	28	12	...
XV.		Lochgilphead (Kilmory)	3·59	+ ·96	1·44	7	14	...	...	...	...	...	...
,,		Oban (Craigvarren)	3·01	...	1·24	7	15	64·4	25	30·2	11	1	...
,,		Mull (Quinish).....	3·48	...	1·06	7	15	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·70	— ·51	·40	3	9	...	...	...	...	...	...
,,		Arbroath	1·09	— ·82	·17	2	11	53·0	13*d*	32·0	1*e*	3	...
XVII.		Braemar	1·61	— ·47	·50	7	14	59·0	27	23·8	21*f*	13	23
,,		Aberdeen	1·15	...	·19	18	17	61·0	27	30·0	9	4	...
XVIII		Lochbroom	3·05	...	·76	8	15	...	...	...	...	...	...
,,		Culloden	·78	— ·57	...	...	...	57·0	26	27·0	11	7	19
XIX.		Dunrobin	1·11	...	·36	7	9	56·0	27	29·5	3	5	...
,,		Kirkwall (Swanbister)..... ..	...	...	...	...	...	..	..	...	...	...	...
XX.	IRELAND.	Cork (Blackrock)	2·50	— ·60	·66	6	15	71·0	28	30·0	2	4	...
,,		Dromore Castle	1·72	...	·60	5	8	70·0	27	31·0	29	...	...
,,		Waterford (Brook Lodge) ...	2·26	...	·62	23	16	64·0	28	28·5	12	3	17
,,		Killaloe	2·23	...	·56	7	14	70·0	27	30·0	12	2	...
XXI.		Carlow (Browne's Hill)	2·03	— ·54	·44	7	13	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·52	— ·59	·37	4	15	64·8	27	31·8	11	1	12
XXII.		Ballinasloe	3·37	+ 1·11	1·43	27	16	65·0	27	28·0	12	11	...
XXIII		Waringstown	1·31	— ·58	·23	6	12	70·0	27	25·0	29	11	18
,,		Londonderry (Creggan Res.).	1·91	...	·42	8	14	...	...	...	...	...	..
,,		Omagh (Edenfel)	1·54	— ·46	·25	6	17	67·0	27	26·0	29	12	...

a And 12. *b* And 30. *c* And 23. *d* And 15. *e* And 7, 10. *f* And 22.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON APRIL, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

BANBURY.—Mean temp. (45°·2) 0°·5 below the average; a rapid fall of temp. occurred on 28th, the reading at 11 a.m. being 65°·0, at 2 p.m. 50°·0, at 3.45 p.m. 46°·0, and at 6 p.m. 43°·0; cold R fell at night, and S at neighbouring places. TS on 24th; T on 11th; L on 27th; H on six days, S on two, high wind on three.

CULFORD.—A very cold month, ending with a severe frost; polar winds prevailed almost throughout. H and T on 9th, T on 10th and 18th also.

COSSEY.—A very cold month; a remarkably sudden fall of temp. took place on 28th, the thermometer reading 62°·0 at 9 a.m., then rising to 66°·5 before noon, and falling to 49°·0 by 3 p.m., and to 40°·0 by 9 p.m., a fall of 22°·0 in 12 hours.

LANGTON HERRING.—Rainfall 1·10 in. below the average; mean temp. at 9 a.m. 0°·5 above the average. The changes of temp. were very sudden and great, the thermometer reading 67°·0 at 10·30 a.m. on 28th, and 39°·0 at 10·30 a.m. on 29th, a difference of 28° at the same hour on two consecutive days. The 28th was the hottest day in April since 1875. Solar halos on six days; L, sleet and H on 9th.

STROUD.—TS on 24th from 6 p.m. to 7 p.m.; T on 28th; H on 7th and 9th: sleet on 9th; S on 29th.

WOOLSTASTON.—Cold nights and constant easterly winds kept all vegetation very backward; the cuckoo was heard on 19th, but swallows were not seen till the last week in the month; mean temp. 45°·2. T and L on 11th; S on 9th and 28th.

ORLETON.—The weather was very stormy, cold and rainy till 18th. On 10th R set in about 5 a.m., changing to S, and covering the ground by noon, when the sky cleared very suddenly. About 2.15 p.m. on 11th a storm of L, T, H and R passed over from N.N.E. to S.S.W., with great darkness, followed by a clear sky and frost at night. After the 18th the weather became fine and warm, and vegetation progressed rapidly; the 27th was fine and warm with L at night, followed by a change of wind to N.E. on the next day, and severe frost on the morning of 30th. Mean temp. 2°·3 below, and rainfall slightly below the average. The cuckoo was generally heard on 22nd, and swallows appeared on 23rd; plums and damsons came into bloom on 26th, and cherry trees a few days later.

LEICESTER.—The early part of the month was cold and wet, subsequently it was milder, and towards the close changeable. On 28th the dry bulb registered 57°·8 at 9 a.m., 46°·0 at noon, and 38°·5 at 9 p.m.

KILLINGHOLME.—The month was very cold throughout, everything in field and garden suffering and being backward in consequence; high wind prevailed at the beginning; distant T at noon on 8th, T and L at 5.45 a.m. on 28th.

MANCHESTER.—April opened with genial showers and mild temp., which at once gave a start to vegetation, but as the month progressed the cold easterly winds returned,—S fell among the hills—the temperature fell, and the month closed with frost.

WALES.

HAVERFORDWEST.—During the first twelve days there was constant R, but vegetation did not make much progress owing to the low mean temp. S fell all day on 10th, particularly during the afternoon and evening; the Precelly range and all the high lands presented a very wintry appearance, the S being 6 inches deep at Rosebush, Precelly. From 23rd to 28th very fine warm weather prevailed, culminating in a TS of some magnitude; after the storm the weather became suddenly very cold, the temp. falling on the night of 30th to 31°·0. Owing to the unusual heat of the last fortnight, the mean temp.

(49°·5) was above the average, though the temp. was within two degrees of the freezing point on four nights, besides the four on which it fell below 32°. Blackthorn was in blossom on 26th.

LLANDUDNO.—The month maintained its traditional character for variability, especially as regards temp., which rose to nearly 60°·0 on the 2nd, but fell to 49°·0 on the next day, and continued considerably below the average till the 23rd, when it rather suddenly rose and continued rising till the 27th, but on 29th the max. was only 47°·0 and the min. 37°·0. The mean temp. (46°·4) was one degree below the average, the mean daily range (12°·1) 1°·3 below, and the monthly range (34°·5) 1°·9 above the average. April, though proverbially showery, is yet one of the driest months of the year, and in both these respects it was this year true to its character. The air was exceptionally dry, and, as is usual at this season, polar winds were prevalent, but happily their keenness was much tempered by abundant sunshine (142 hours), especially towards the end of the month; this contributed in no small degree to make the late Easter one of the finest on record. Gale on 3rd, S on 10th, T on 27th, cuckoo heard on 24th.

SCOTLAND.

CARGEN.—The first part of the month was stormy and wet, but easterly winds prevailed continuously from the 16th to the end, and on one or two occasions the temperature varied as much as 30°·0 in 24 hours. Mean temp. 1°·3 below the average, sunshine about the average. H, S and R on 6th.

JEDBURGH.—The weather was cold and ungenial, especially during the latter half of the month; seed was well got in, but vegetation generally was far behind, though there was good promise of all tree and bush fruit. S on 10th and 28th.

QUINISH—From 1st to 9th, it was very cold and wet, the rest of the month was cold and dry, with frequent frost at night. The cold and late spring following on an unusually severe winter is proving disastrous to hill sheep-farmers.

BRAEMAR.—A very cold ungenial month.

ABERDEEN.—Dry weather was the chief feature of the month, as is shown by the fact that the rainfall was more than an inch below the average.

LOCHBROOM.—The wildness of March continued until the 10th of this month, after which beautiful dry sunshiny weather, though rather cold, prevailed, with occasional showers of H and frequent night frosts; no congenial warmth was experienced, so that vegetation of every kind was very backward at the close, and stock, especially sheep, very lean. S fell on 1st; a hurricane blew on 2nd, 3rd and 4th.

CULLODEN.—The weather during the month was unusually dry, with cold N.E. winds and much frost; all vegetation was exceedingly late.

IRELAND.

BLACKROCK.—The first ten days were showery with H at times, and four frosty nights, thence fine mild weather prevailed to the 18th, after which it was mostly dull to the 24th, from the 25th to 27th was milder; R L and T on 28th, the last two days were bright and cold, with frost on 30th.

DROMORE.—The beginning of the month was very wild, stormy and wet, but after the first week the weather somewhat improved. E. winds prevailed throughout.

WATERFORD.—E. winds prevailed during the month. S in remarkably large flakes fell on 10th, and was seen lying on the Comeragh Mountains. Dense fog on 24th; a double rainbow at 6.15 a.m. on 27th, frost on 30th, H on five days. Swallows were seen on 23rd, cuckoo heard on 25th.

KILLALOE.—Cold and high winds prevailed till 12th, and low temp. till 25th; S on 10th.

DUBLIN.—Opening with unsettled, stormy and showery weather, the month proved finally to be both dry and cold, only ·55 in. of R falling after the 9th,

on six days, and E. to N.W. winds blew almost constantly during the same period, previously strong S. to W. winds had prevailed with higher but unstable temperature and frequent showers. The mean temp. was the lowest recorded in April, with three exceptions in the 20 years 1865–84. Sleet fell on 6th; H on six days; fog on five, high winds on nine, six of which were in the first week; solar halos on 12th and 17th. Mean humidity 80; mean amount of cloud 5·4; prevailing winds N.E., E. and W.

SEVERE HURRICANE IN FIJI.

SYDNEY, March 17. News was received here at a late hour to-night respecting the damage done at Levuka by a hurricane. The house erected on a point beyond Nasova by D. Wilkinson was carried away. From Nasova to the site of the old Commercial Hotel the houses have escaped with superficial damage. Thence along the main line nearly all the houses are down or badly damaged. At the native town, Levuka, the houses were badly blown about, and Palmer's boat-shed was blown down. The houses below seem only to have suffered to a slight extent. Back from the main line the chief damage is Paul's residence unroofed and wrecked, an old building opposite the Wesleyan Church a heap of ruins, a house formerly occupied by Mr. G. A. Woods badly damaged, Mr. F. B. Swann's residence unroofed and badly injured, the Royal Hotel wrecked. Four houses in the rear of it, on the right bank of Tooga Creek, are a heap of ruins. Four of Henning's new cottages are unroofed. Grave's residence, the highest place of all, is lifted off the piles, and set at an angle of 30°. At Parfitt's residence the dining room and its contents are dispersed, only the main building being left standing. At the native gaol the walls only are left standing. The Good Templars' Hall was lifted 10 ft. bodily out of position, and utterly wrecked. Four natives have been killed.—*Melbourne Argus.*

A DUST COLUMN.

Mr. J. B. Muirhead writes, under date May 5th: "An occurrence, which I had the pleasure of witnessing this morning, may perhaps interest your readers. Driving past Aylesford Station I came suddenly on a beautiful dust column standing upright on the road at about 20 yards distance. It was of a uniform diameter of about 4 feet, and rose whirling to a height of 100 feet or more, its summit reaching considerably above a tall poplar, beside which it passed in its slanting progress across the highway. Leaving the road, and advancing into a field, it was gradually dispersed by the gentle easterly breeze, somewhat in the manner in which the train of a rocket vanishes in the sky at night."—*Daily News.*

A COLLECTION OF ——.

In 1303 and 1304 the Rhine, Loire, and Seine ran dry. The heat in several French provinces during the summer of 1705 was equal to that of a glass furnace. Meat could be cooked by merely exposing it to the sun. Not a soul dare venture out between noon and 4 p.m. In 1718 many shops had to close. The theatres never opened their doors for three months. Not a drop of water fell during six months. In 1773 the thermometer rose to 118 degrees. In 1778 the heat at Bologna was so great that a great number of people were stifled. There was not sufficient air for the breath, and people had to take refuge under the ground. In July 1793 the heat again became intolerable. Vegetables were burned up, and fruit dried on the trees. The furniture and woodwork in dwelling-houses cracked and split up; meat went bad in an hour. *Amateur Photographer.*

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THE MAY FLOODS OF 1886.

(Illustrated by a Map.)

IN these pages and in those of *British Rainfall* we have pleaded over and over again for the wider and more systematic employment of Flood marks. The excessive rains of the middle of the past month have produced floods which, over a large portion of England and Wales, were quite exceptional (especially considering the period of the year) and on some rivers unprecedented, or, at any rate, beyond any recorded precedent. We hope that the height of these floods will be duly marked on as many bridges and permanent buildings as possible. A horizontal line with a cross at each end and the date, is easily cut and tells its own tale—X $\frac{\text{May 16}}{1886.}$ X.

We are glad to hear that a paper upon these floods is being prepared for the Royal Meteorological Society by Messrs. Gaster and Marriott —we shall do all that we can to help them, and also to avoid running over ground which they will doubtless occupy better—for instance, Mr. Gaster's conversance with weather forecasting and the behaviour and may we say misbehaviour, of cyclonic systems renders him exceptionally able to deal with the *causes* of the enormous rainfall, while the number of records with which we are favoured gives us the best means of indicating the areas of most exceptional fall. We shall therefore, on the present occasion, deal with only two branches of the subject—*Total Rainfall* and *Flood Levels*, and at the end merely quote a few lines from *Nature* respecting the Cyclones, and print a few of the letters which we have received. The records of damage will doubtless be fully treated in Messrs. Gaster and Marriott's paper; the total must be enormous.

Stations at which the fall of rain on May 11th to 13th reached or exceeded 2 inches.

Div.	County.	Station.	11th	12th	13th	11–13
III.	Oxford	Oxford, Magdalen College	·35	1·25	·48	2·08
,,	,,	,, Radcliffe Observatory	·36	1·30	·51	2·17
,,	Northampton	Oundle	·36	·87	1·02	2·25
V.	Wilts	Warminster	·36	2·22	·47	3·05
,,	Somerset	Weston-super-Mare, High St.	·27	·97	·93	2·17
VI.	Gloucester	Clifton, South Parade	·28	1·07	·96	2·31
,,	,,	Bristol, Shirehampton	·35	1·11	·82	2·28
,,	,,	Stroud, Upfield	·32	1·72	·78	2·82
,,	,,	Gloucester, Llanthony Lock	·28	1·52	·90	2·70
,,	,,	,, Maisemore Lock	·34	1·64	1·01	2·99
,,	,,	Tewkesbury, Upper Lode	·30	1·31	1·10	2·71
,,	Hereford	Ross, The Graig	·28	1·70	1·40	3·38
,,	,,	Much Dewchurch, Bryngwyn	·30	2·64	1·86	4·80
,,	,,	Hereford	·27	1·65	3·50	5·42
,,	,,	Hope-u-Dinmore, Hampton Ct.	·25	1·90	2·03	4·18
,,	,,	Kington, Lynhales	·63	1·93	2·40	4 96
,,	Shropshire	Ludlow, Ashford	·37	2·22	?	?
,,	,,	Dowles, Bewdley*	1·16	2·03	·86	4·05
,,	,,	Cleobury Mortimer, Neen Savage	·33	2·08	2·32	4·73
,,	,,	Craven Arms, Stokesay Vic.	·54	2·20	2·57	5·31
,,	,,	Burwarton	·60	3·10	3·39	7·09
,,	,,	Bishop's Castle, Castle St.	·57	1·75	3·30	5·62
,,	,,	,, ,, More Rectory.	·47	1·67	3·59	5·73
,,	,,	Much Wenlock, Larden Hall	·35	2·75	3·30	6·40
,,	,,	Church Stretton, Preen Manor	·44	2·22	3·25	5·91
,,	,,	,, ,, Woolstaston.	·58	2·42	3·32	6·32
,,	,,	Middleton in Chirbury	·49	1·39	2·34	4·22
,,	,,	Much Wenlock, Willey Park	·50	2·04	2·21	4·75
,,	,,	Broseley, Benthall Hall	·50	2·04	2·21	4·75
,,	,,	Oswestry, Hengoed	1·58	1·92	1·60	5·10
,,	,,	Market Drayton, Buntingsdale	·39	·75	2·35	3·49
,,	Stafford	Abbots Bromley, Hoar Cross	·32	1·61	1·90	3·83
,,	,,	Cheadle, The Heath House	·27	1·20	1·65	3·12
,,	Worcester	Gt. Malvern, Madresfield	·31	1·98	1·76	4·05
,,	,,	Worcester, Diglis Lock	·25	1·85	1·65	3·75
,,	,,	,, Bevere Lock	·22	1·63	1·72	3·57
,,	,,	Droitwich, Holt Lock	·22	1·63	1·81	3·66
,,	,,	,, Ombersley	·17	1·52	1·40	3·09
,,	,,	Tenbury, Orleton	·28	2·23	2·12	4·63
,,	,,	Stourport, Lincombe Lock	·29	1·67	1·55	3·51
,,	Warwick	Stratford-on-Avon, Avonside	·30	1·20	·94	2·44
,,	,,	Coventry, Priory Row	·25	1·30	·96	2·51
,,	,,	,, Coundon	·27	1·40	1·05	2·72
,,	,,	Atherstone	·20	1·26	1·50	2·96
VII.	Leicester	Little Orton	·30	1·00	1·45	2·75
,,	,,	Loughborough, Victoria St.	·17	·81	1·39	2·37
,,	Rutland	Ketton Hall [Stamford]	·34	·78	1·51	2·63
,,	Lincoln	Horncastle, Bucknall	·13	·35	1·60	2·08
,,	,,	Brigg	·07	·58	1·44	2·09
,,	Nottingham	Newark	·13	1·05	2·03	3·21
,,	,,	Mansfield, Market Place	·13	1·43	2·00	3·56
,,	,,	Welbeck	·07	1·12	2·30	3·49

* Measured at 8 p.m.

Div.	County.	Station.	11th	12th	13th	11–13
VII.	Derby	Belper, Northfield	·17	1·81	1·26	3·24
,,	,,	Wirksworth, Holloway	·43	2·48	1·90	4·81
,,	,,	Chatsworth Gardens	·30	1·81	2·19	4·30
VIII.	Cheshire	Chester	·73	1·50	1·31	3·54
,,	,,	Frodsham, Foxhill	·84	1·24	1·36	3·44
,,	,,	,, Dunsdale	·66	·96	1·60	3·22
IX.	Yorks, W.R.	Wakefield, Stanley Vicarage	·07	1·40	1·00	2·47
,,	,,	Ripon, High Bank, Mickley	·03	1·59	·59	2·21
,,	,, E.R.	Houghton	·10	·20	1·86	2·16
,,	,, N.R.	Ingleby, Greenhow Vicarage	·01	·51	2·17	2·69
X.	Cumberland	Wythburn Vicarage	·75	·85	·84	2·44
XI.	Monmouth	Llanfrechfa Grange	·85	2·25	1·40	4·50
,,	,,	Abergavenny, Larchfield	·88	2·77	1·44	5·09
,,	Glamorgan	Cardiff, Ely	·65	·82	1·53	3·00
,,	,,	,, ,, Park Place	·66	1·22	1·01	2·89
,,	Carmarthen	Llandovery	·37	·68	1·47	2·52
,,	Pembroke	Castle Malgwyn, Llechryd	·63	·82	1·73	2·18
,,	,,	Clarbeston, Pentry Park	1·16	·16	1·06	3·38
,,	Cardigan	Aberayron, Dolaeron	·35	·62	1·51	2·48
,,	Brecknock	Hay, Gwern-y-fed	·43	1·06	2·31	3·80
,,	,,	Builth, Llanwrtyd Wells	·11	1·00	2·19	3·30
,,	,,	,, Abergwessin Vic	·73	1·61	2·44	4·78
,,	Radnor	Llanstephan	·77	1·11	1·82	3·70
,,	,,	Llandrindod Wells, Brynarlais	...	·68	1·56	2·24
,,	,,	New Radnor, Downton	·51	1·69	2·81	5·01
,,	,,	,, Penybont	·35	·70	2·11	3·16
,,	,,	,, Ednol	·51	1·52	2·53	4·56
,,	,,	,, Gwern-y-Arglwydd	·50	·90	3·10	4·50
,,	,,	Rhayader, Nantgwillt	·79	1·47	1·33	3·59
,,	Montgomery	Carno, Llanwnog	·55	·98	2·70	4·23
,,	,,	,, Tybrith	·82	1·10	2·23	4·15
,,	,,	Welshpool, Buttington Vic.	·90	1·30	2·65	4·85
,,	,,	Garthbibio, Rhos-y-perfedd	·41	1·97	·85	3·23
,,	Denbigh	Rosset, Trevalyn Hall	·91	1·65	1·36	3·92
,,	Merioneth	Corwen, Rhug Gardens	·10	·84	1·77	2·71
,,	Carnarvon	Llandudno, Warwick House	1·02	·81	·29	2·12
,,	Isle of Man	Douglas, Victoria Road	·64	2·27	·05	2·96
XX.	Tipperary	Derrycastle [Killaloe]	·98	·67	·44	2·09
XXI.	Wexford	Gorey, Courtown House	1·02	·45	1·11	2·58
,,	Dublin	Dublin, FitzWilliam Square	1·15	1·27	·45	2·87
,,	Meath	Navan, Balrath	1·09	2·08	...	3·17
XXII.	Mayo	Crossmolina, Enniscoe	1·24	·74	·09	2·07
XXIII.	Down	Kilkeel	1·02	2·50	·23	3·75
,,	,,	Seaforde	·86	2·48	·40	3·74
,,	,,	Waringstown	·72	2·05	·01	2·78
,,	,,	Newtownards	·89	2·12	·10	3·11
,,	,,	Donaghadee	·63	1·40	·14	2·17
,,	Antrim	Belfast, New Barnsley	·57	1·67	·03	2·27

On the map the total rainfall is given only to the nearest inch; this is an unusual course, but we believe that it greatly facilitates the seizing of the leading features of the geographical distribution of the fall.

Judging from the data already before us, there can be no question that the fall was heavier in the neighbourhood of Wenlock Edge and

the Brown Clee Hills, that is to say in the southern half of Shropshire, than anywhere else. Falls of upwards of 4 in. in the three days were, however, recorded in Monmouth, Hereford, Worcester, Radnor, Shropshire, Montgomery, Denbigh, and Derbyshire.

As regards the river basins over which it fell, the Severn, of course, had the lion's share; but it was not its head waters which would apparently be most swollen, but the part near Shrewsbury, and most of all its affluent the Teme, which joins the Severn a little below Worcester. It is extremely fortunate that this flood has come in 1886 instead of in 1885, for during the present year there is in full operation a system of rain and flood recording for the Severn watershed, organised by Mr. J. W. Willis Bund, which will very greatly add to the fulness of our final record of this great flood.

The Wye would also have a considerable flood, but we have at present no record of its volume.

The Warwickshire Avon, which flows into the Severn, would have but little flood, and this is borne out by the note respecting the smallness of the flood with which we have been favoured by Messrs. C. Lucy and Co.

The Don running through South Yorkshire, past Doncaster, was considerably flooded, the rainfall in N.E. Derbyshire being excessive.

FLOOD LEVELS.

GLOUCESTER—

				ft.	in.
May 15th,	9	p.m.,	depth of water at lock gates on the quay	21	6
,, ,,	11	,,	,, ,, ,, ,, ,,	21	7
,, 16th,	3.45	a.m.	,, ,, ,, ,, ,,	22	0
,, ,,	7.30	,,	,, ,, ,, ,, ,,	22	1
,, ,,	9	,,	,, ,, ,, ,, ,,	22	1½
,, ,,	4	p.m.	,, ,, ,, ,, ,,	22	1¾
,, ,,	8.30	,,	,, ,, ,, ,, ,,	22	2
,, ,,	8 40	,,	the tide caused it to rise half an inch.		
,, ,,	9	,,	no appreciable difference was manifested.		
,, ,,	11	,,	another quarter of an inch was registered	22	2¾
,, 17th,	6	a.m.	it had fallen 3½ inches.	21	11¼

In 1795 the river rose to 22 ft. 8½ in.
In 1852, Sept. 15 ,, 22 ,, 7 ,,
In 1877, Jan. 5 ,, 21 ,, 3 ,,

TEWKESBURY—The highest flood since 1852.

Ross.—May 15th, flood on Wye 14 ft.

BROMYARD.—1886 flood 38 inches above the mark of 1852 in Knightwick Mill.

LEOMINSTER.—The arches of the bridge over the Arrow at its crossing Hereford Road were full, an event never known before; in 1835 there was a great flood, but not equal to 1886.

IVINGTON (NEAR LEOMINSTER).—Heavy flood in the Arrow in 1879, but not equal to 1886 by some feet.

LUDLOW.—The Teme supposed to be six or eight feet higher than ever known before.

STOKESAY.—River higher than ever known before.

MIDDLETON IN CHIRBURY.—Highest flood ever known in the river Camlad, an affluent of the Severn.

HENGOED, OSWESTRY.—Bridge carried away, and all my lower rooms flooded.

SHREWSBURY.—May 15th, noon, extreme height of flood at Welsh bridge, 16 feet.

WORCESTER—

			ft.	in.	
May 11th,		Water in the Severn	4		above average summer level
,, 12th		,, ,, ,,	5	,,	,, ,, ,,
,, 13th, 7	a.m.	,, ,, ,,	2	6	,, ,, ,, ,,
,, ,, 4	p.m.	,, ,, ,,	10	0	,, ,, ,, ,,
,, ,, 8	,,	,, ,, ,,	11	9	,, ,, ,, ,,
,, 14th, 7.15	a.m.	,, ,, ,,	14	3	,, ,, ,, ,,
,, ,, 11.40	,,	,, ,, ,,	15	8	,, ,, ,, ,,
,, ,, 5.30	p.m.	,, ,, ,,	17	0 (nearly)	,, ,, ,,
,, 15th, 1	a.m.	,, ,, ,,	17	10*	,, ,, ,, ,,

WORCESTER, DIGLIS LOCKS.—The highest flood for 115 years, and only a few inches below that of 1770.

STRATFORD-ON-AVON.—Flood not nearly so great here as in the Severn at Worcester, &c. Here it was 2 ft. less than in 1875, and has often been exceeded.

NOTTINGHAM.—Last evening (Saturday), May 14th, the height of the water at the Trent Bridge was 30·70 feet, or, in other words, about 8 inches above the springing of the arches of the bridge, or 78·65 feet above mean sea level at Hull. This represents the highest flood but one of the present century. Two extraordinary floods occurred in the Trent Valley in the year 1875; the first was remarkable, not only for its height, but on account of the period of its occurrence—viz., in the month of July. The second, in October, was the highest flood of the present century, and the highest recorded Trent flood except that of 1795, which slightly exceeded it. The July flood attained its maximum height at the Trent Bridge, on Friday, the 23rd day of July at 7.30 a.m., at which time the water had risen to the springing of the large iron arches of the Trent Bridge, and was 77·95 feet above mean sea level at Hull, or 12 feet above the summer level of the Trent. The second, or October flood, attained its maximum height at the Trent Bridge on Friday, the 22nd day of October, at 10 a.m., at which time the water had risen 1 ft. 9 in. above the springing of the iron arches, and was 79·70ft. above mean sea level, or 18·75ft. above the summer level of the Trent. The following is a list of the several floods in the river Trent, and the height of each is given in feet and decimals at the Trent Bridge, Nottingham above mean sea level :—

1795, (estimated)	80·55 feet.
1852, November	79·37 ,,
1857, ...	77·38 ,,
1864, March	77·13 ,,
1869, December	78·45 ,,
1875, July	77·95 ,,
1875, October	79·70 ,,
1886, May	78·65 ,,

The estimated height of the 1795 flood is derived from several sources, having nearly coincident results. It is very extraordinary that after only five days' rainfall the water should have risen to such large dimensions.

The rise of the water in the Trent has been exactly 12¼ feet, *due to 120 hours' rain.*—M. OGLE TARBOTTON, *Consulting Engineer to the Corporation of Nottingham.*

* Highest since 1852, and only 6 in. below 1795.

BELPER.—Derwent in flood from 10 a.m. of 13th, and rose till 4.30 p.m., when it was higher than for about 40 years.

N.E. YORKSHIRE.—May 15th, p.m., the Derwent had risen to nearly 11 feet above summer level.

THE WEATHER OF THE ICE SAINTS FESTIVALS OF 1886.

In the British Islands the cold acquired its greatest intensity on the five days from May 11 to 15, and was coincident with a system of pressures which appeared in the Channel, and thence proceeded in a north-north-easterly direction through the North Sea to the south-west of Norway, which was reached on the 15th. It necessarily resulted from this distribution of pressure that northerly and easterly winds prevailed in these islands, and temperature fell correspondingly low. Over that large portion of the British Islands lying between lat. 52° and 58°, the mean temperature of the five days was at least 6°·0 under the average of the season, and in the central portion of this district, as at York and Barrow-in-Furness, it was 8°·3 under the average. On the other hand, in Jersey the defect from the mean was only 1°·5, and in Shetland 2°·5. At Barrow-in-Furness, on the 12th, the maximum temperature was only 39°·0. On this day snow fell over the higher districts of central and southern Scotland, in many places to the depth of several inches, and the cold was so intense that swallows and some other birds perished in thousands.

Meanwhile torrents of rain were being poured down continuously over wide districts of northern and central England. These rains were heaviest and most widespread on the 11th, 12th, and 13th, on each of these days upwards of an inch being recorded in many places. Mr. Scott states in the *Weekly Weather Report* that during these three days falls of 4·83 inches occurred at Churchstoke, Montgomeryshire; 4·36 inches at Hereford; 4·15 inches at Pershore, Worcestershire; 3·38 inches at Ross, Herefordshire; and 3·44 inches at Fassaroe, county Wicklow. Extensive and disastrous floods were the consequence. The railway traffic between Worcester, Hereford, and Malvern was suspended, and the whole of the united valley of the Severn and Teme, in the neighbourhood of Worcester, was laid under water. At Gloucester large numbers of the inhabitants were driven from their homes. The valley of the Trent presented the appearance of a vast lake, and the Midland Railway between Nottingham and Derby was submerged. Immense damage was done about Chester and along the estuary of the Dee, over the low grounds bordering the Humber, and over extensive tracts of Yorkshire,

A noteworthy feature of the storm is shown in the weather maps for the morning of the 13th, when the area of low pressure extending from west to east over the south of England was broken up and showed three satellite cyclones with still lower pressures, having their centres the first to the west of Brest, the second over Somersetshire, and the third over Kent,—these all evidencing great, well-marked, and sharp local differences in the distribution of temperature and vapour. Further, a most remarkable satellite cyclone was seen near Perpignan, in the south of France, which in all probability represented the small cyclone or tornado that about seven o'clock of the previous evening wrought such dreadful havoc in Madrid, causing 32 deaths, seriously wounding large numbers, variously estimated from 320 to 520 persons, and wrecking hundreds of houses.—*Nature*.

GREAT RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall of last week was so excessive in this part of the kingdom, and the floods that followed were so extraordinary, that they deserve a record in your Magazine.

On Tuesday the 11th of May, after a very dark and gloomy day, small rain commenced falling before five in the afternoon, and continued, with slight intermissions, during which a few spots of rain fell, till 10 a.m. on the 12th, a thick steady fall of rain then set in, which continued without intermission, till 10 a.m. on the 14th, when it ceased; and before one o'clock the sun shone, disclosing the Clee hills and the Welsh mountains covered with snow, and the valley of the Teme filled with an immense flood.

The following is the amount of rain that was registered here on five days:—

	in.
10th	·140
11th	5·280
12th	2·225
13th	2·120
14th	·010
Total.....	4·775

The fall on the 12th and 13th is the largest fall in two successive days that I have ever recorded during 56 years. The nearest approach to it was in July, 1834, when 4·585 in. fell in four days, but the greater portion of this fell on the first day in a thunderstorm.

On the 14th, the River Teme was 4 ft. higher at Stanford Mill than it was in the great flood of November, 1852, and higher than it was in the greater flood of 1795.

At Tenbury the flood water was 5 ft. or 6 ft. deep in the principal streets, and all postal communication was cut off. Great damage was done to the shops, and one man was drowned in his kitchen. The water rose above the seats in the Parish Church. All communication between the two sides of the valley was cut off for more than 20 miles. Several of the bridges were swept away, and others greatly damaged, and rendered almost impassable, especially the Iron Bridge at Stanford.

On the 15th, the River Severn at Worcester rose above the mark of the great flood of 1795, and occasioned great damage.

I remain, yours very truly,

THOS. HENRY DAVIS.

Orleton, Tenbury, May 20th, 1886.

To the Editor of the Meteorological Magazine.

SIR,—I herewith send you particulars of the exceptional rainfall of the past few days.

Rain commenced to fall at 5.30 p.m. on the 11th, and continued without ceasing until 6 a.m. to-day, being a total of 60 hours. A heavy fall of snow occurred early this morning; on the Bishop's Castle Railway considerable damage has been done to the permanent way for a long distance, caused by overflow of the Onny River.

The following are my gauge measurements :—

	in
Tuesday, May 11th	0·57
Wednesday, May 12th.....	1·75
Thursday, May 13th	3·30
	5·62

In addition, ·17 in. fell on Monday the 10th.

This is the greatest fall I have registered in 15 years, and probably a larger amount than ever fell in this neighbourhood in the time. Road traffic is also greatly interrupted.—Yours truly,

E. GRIFFITHS.

Bishop's Castle, 14th May, 1886.

To the Editor of the Meteorological Magazine.

SIR,—I greatly regret that I am unable to give you a complete return of the extraordinary rainfall in May. The fall for the 11th was ·37 in., for the 12th 2·22 in., but on the morning of May 14th I was flooded with 16 in. of water in the hall from 2 a.m. till 2 p.m., and unable to get out of the house till 3 o'clock. I then found that something must have washed against the rain gauge and upset it, and the small fence which I had erected round it for its protection. Consequently the rain "measure" for Thursday and Friday are both wanting.

I have not yet been able to make exact measurements of the height of the flood, as the river has not yet sunk to its average condition. You may have some notion of the violence of the flood when I tell you that part of the garden was scoured away, the whole of the cultivated soil being removed, and this more than 12 feet above the ordinary level of the river.—Yours truly,

J. SELWOOD TANNER.

Ashford, near Ludlow, 10th June, 1886.

SUMMER AND WINTER IN A WEEK.

To the Editor of the Meteorological Magazine.

SIR,—The conditions of weather experienced during the period May 6th to May 13th were so very extraordinary, that a few facts relating thereto may not be without interest.

On the 6th and 7th the maximum shade temperatures were respectively 68°·8 and 66°·6, while the black bulb thermometer *in vacuo* registered 118°·2 and 121°·2. At 9 a.m. on the 7th, the dry bulb read 60°·8 and the wet bulb 39°·7, showing the unusual difference of 21°·1, the greatest I have ever recorded except on May 23rd, 1884, when, at 3.40 p.m., the readings were, dry 85°·0, wet 58°·0. These two days were beautifully fine and warm, but thereafter the weather rapidly changed for the worse. The cold, drizzling rain of the 8th, 9th, 10th and 11th, although sufficiently disagreeable, proved only the forerunner of worse things, for than, on the 12th and 13th, no more bitter and unpleasant weather occurred during the past winter. Rain, sleet, and soft snow, driven by biting blasts from the eastward,

prevailed on these days, and the mountains of the Lake district and those of the Pennine range were thickly covered with snow. From the 8th to the 13th there was not a single gleam of bright sunshine, while the maximum shade temperature fell to 42°·7 on the 11th, 40°·3 on the 12th, and 44°·0 on the 13th. The minima in the screen and on the grass on the 12th were 34°·0 and 32°·0. The 9 a.m. dry bulb reading on the same day was 38°·2, being 22°·6 lower than the corresponding value on the 7th. Vegetation has received a check which, in the case of some forest and fruit trees, will not be recovered this season, the newly opened leaves having been shrivelled and blackened, or blown about as on an autumn day. In the mountain districts hundreds of lambs succumbed to the intense cold of the 12th, and thousands of swallows and other summer migrants have perished.

THOMAS G. BENN, F.R.Met.Soc.

Newton Reigny Observatory, May 18th, 1886.

PERIODICAL RECURRENCE OF WARM SUMMERS.

To the Editor of the Meteorological Magazine.

SIR,—The weather cycle of 17 years, to which Mr. Gwilliam drew attention in your last number, ought to give us some periods of excessive heat in the summer of this year. In 1869 (17 years ago) we had a "warm summer of long duration," and if we go back from that year to the commencement of the present century, we find that there has been no interruption to the recurrence of hot weather after an interval of 17 years. Excessive heat occurred in 1852, 1835, and 1818, and in 1801 the summer was very hot in August and September. This shows a return of great heat, in each case, at the end of 17 years.

We seem to have a great many other weather cycles, which apply very well to summers. We have the recurring summer periods, or cycles, of 8, 10, 12, 19, 29, 39, 40, 68, and 136 years. Now it is a curious fact that all these cycles, except that of 19 years, appear to apply to the coming summer. Eight years ago we had the hot summer of 1878. Ten years ago we had the very hot summer of 1876. In 1874 (12 years ago) the summer was very hot. Then if we go back 29 years we find that the summer of 1857 was remarkably hot and fine. If we travel back 39 years we reach the very hot summer of 1847. And 40 years ago we had "the notably hot summer of 1846." In 1818 (68 years ago) we had an extremely hot and dry summer. In 1750 (136 years ago) most extraordinary heat occurred in the course of the summer. In that year, "from the 17th to the 21st of June, and from the 8th to the 12th of July, it was the hottest weather in the memory of man." With regard to the cycle of 425 years, referred to in my last letter, the weather of the year 1461 does not appear to be anywhere recorded. The number 136 is the least common multiple of 8 and 17; and as the recurring period of 8 years is almost as striking as that of 17 years, we ought to have

some waves of very great heat during the coming summer, notwithstanding the adverse influence of the late severe winter.

There is an astronomical cycle which corresponds to the meteorological one of 8 years. When a transit of Venus occurs after a long series of years, we have a recurrence of that phenomenon once after an interval of 8 years. A transit of that planet across the sun's disc occurred in 1761, and another transit happened in 1874, and in each case the phenomenon was repeated at the end of 8 years, viz., in 1769 and 1882. Another transit of Venus will occur in January, 2004, and will be repeated at the end of 8 years, in January, 2012.

In the period of 8 years, as well as that of 40 (which is a multiple of 8), we have a very good weather cycle. Warm summers occurred in 1800, 1818, 1819, 1826, 1827, 1834, 1842, 1850, 1851, 1857, 1865, 1868, 1870, 1873, and 1876; which heat returned in each case, 8 years after, viz., in the years 1808, 1826, 1827, 1834, 1835, 1842, 1850, 1858, 1859, 1865, 1873, 1876, 1878, 1881, and 1884. The recurrence of excessive heat after an interval of 40 years is equally emarkable.

Luke Howard had so good an opinion of the 17 year cycle that he predicted a return of the cold of 1816 for 1833, and the warm temperature of 1806 for 1823. The cool summer was repeated in 1833, but the warm season returned a year earlier than he expected, viz., in 1822.—Yours truly,

GEORGE D. BRUMHAM.

Barnsbury, May 31st, 1886.

ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on Wednesday evening, the 19th inst., at the Institution of Civil Engineers; Mr. W. Ellis, F.R.A.S., President, in the chair. Mr. L T. Cave and Rev. Clifford Malden, M.A., were elected Fellows of the Society.

The following papers were read:—1, "The Severe Weather of the Past Winter, 1885-6," by Mr. C. Harding, F.R.Met.Soc. The author showed that the whole winter was noticeable for exceptional cold, not so much on account of any extremely low temperatures experienced, as for the long period of frost and the persistency with which low temperature continued. In the south-west of England there was not a single week from the commencement of October to March 21st in which the temperature did not fall to the freezing point. In many parts of the British islands frosts occurred in the shade on upwards of sixty nights between the beginning of January and the middle of March, and during the long frost which commenced in the middle of February and continued until March 17th, the temperature fell below the freezing point in many places on more than thirty consecutive nights. At Great Berkhampstead, Hertfordshire frost occurred on the grass on seventy-three consecutive nights,

from January 5th to March 18th. The winter of 1885-86 was the only one in which there was skating on the water of the London Skating Club in Regent's Park in each of the four months, December to March, since the formation of the Club in 1830, and there are but four records of skating in March during the fifty-six years, and there is no record of so many days in March as in 1886.

It was shown that the total range of the temperature of the water of the Thames at Deptford from January 8th to March 20th was only 6°, whilst from March 1st to 19th the highest temperature was 36°·5, and the lowest 35°.

The temperature of the soil at the depth of 1 foot was generally only about 2° in excess of that of the air over the whole of England, and from March 1st to 17th the earth was colder than usual by amounts varying from 6°·3 at Lowestoft, to 8°·5 at Norwood. The facts brought together showed that the recent winter was one of the longest experienced for many years, and that in numerous ways it may be characterised as most severe.

2. "Description of an Altazimuth Anemometer for Recording the Vertical Angle as well as the Horizontal Direction and Force of the Wind," by Mr. L. M. Casella. Inasmuch as no current of air is absolutely horizontal, and in the positions in which anemometers are placed the wind is probably generally far from horizontal, it is obvious that the force recorded by the majority of pressure plates is merely the horizontal component of the wind, and not its total pressure. Mr. L. M. Casella has succeeded in doing that which we believe had never been even attempted before; he has constructed an anemometer in which not only is the pressure plate perpendicular to the wind, both as to altitude and azimuth, but the instrument records continuously all three elements. We consider anemometry to be in a very unsatisfactory state, but that Mr. L. M. Casella's is the best pressure anemometer out, which is saying a good deal.

3. "Earth Temperatures, 1881-1885 by Mr. W. Marriott, F.R.Met.Soc. This is a discussion of the observations of the temperature of the soil at various depths below the surface, which have been regularly made at 9 a.m. at several of the stations of the Royal Meteorological Society during the past five years. The results show that the temperature of the soil at 1 foot at nearly all the stations in the winter months is almost the same as that of the air, while in the other months of the year the temperature of the soil is higher than that of the air at all except the London stations.

4, "Note on the After Glows of 1883-84," by Mr. A. W. Clayden, M.A., F.R.Met.Soc. The author suggests that the after-glows were the result of the vapour erupted from Krakatao, and that the dust and other ejecta played but a secondary part in the production of the phenomena.

REVIEW.

Atlas samengesteld uit de Meteorologische Waarnemingen van het schoonerschip "Willem Barents," in de jaren, 1878-84. Utrecht, 1886.

THE Marine Branch of the Royal Meteorological Institute of the Netherlands has just issued a very neatly finished folio atlas, containing 20 variously coloured plates, in which are collected the results of observations made in the above ship, in the summers of 1878-84 in the Barents Sea—or that part of the Arctic Ocean included between Spitzbergen and Nova Zembla. The charts exhibit deep-sea-soundings, specific gravity, temperature of air and sea surface, winds, weather, and the limits of the ice, in a very clear manner; but we can only briefly refer here to one or two points mentioned in the text. The wind charts are referred to homogeneous areas, the winds being first grouped under eight points for each square degree, and afterwards all the squares are combined in which the same winds prevail, The charts show that in the months of June and July S.W. and S. winds were prevalent, while in July and August they were generally N. and E., especially on the coast of Nova Zembla. In the northern part of the Barents Sea the winds in September were exclusively between N. and S. through W. With regard to the condition of the ice, it was found that its position in any one year, taken in connection with the climate of northern Europe, gave no clue as to its position in a following year. The southern border in the different months varied considerably in different years, with perhaps some slight resemblance in August and September of some years. The years 1878-80 were the most favourable, and the years 1881, 1882 and 1884 very unfavourable for navigation. In 1881, especially, the ice in June and July lay very much to the south, being below lat. 70° in the long. of Greenwich, in June. (It will be remembered that the winter 1880-81 was exceptionally severe in the British Isles). The opposing currents, especially the cold Polar current and the warm Atlantic current, while struggling for the mastery, play a considerable part in causing the great differences in the position of the ice in June and July; while in the months of August and September the warmer water between 77° and 78° N. lat. is kept back by the strong flow of the Polar current, although in some years there is open water as far as Francis Joseph Land.

We cannot help thinking it is a pity that the traditions of the Institute have been departed from by the omission of a French translation of the Dutch text.

J. S. HARDING.

BAROMETRIC WELLS.

A correspondent suggests that credit for the facts in the letter on p. 57 should be given to *Ciel et Terre*, which devoted a page to the subject in the latter part of 1884. That article was however apparently founded on a paper in *Cosmos*, Vol. IX. No. 4, and whether even that was the "real original" or not we cannot say.

SUPPLEMENTARY TABLE OF RAINFALL, MAY, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	3·97	XI.	Castle Malgwyn	5·31
,,	Margate, Birchington...	2·97	,,	Rhayader, Nantgwillt..	7·19
,,	Littlehampton	4·57	,,	Carno, Tybrith	6·38
,,	Hailsham	3·49	,,	Corwen, Rhug	4·97
,,	I. of W., St. Lawrence.	3·43	,,	Port Madoc	4·26
,,	Alton, Ashdell.....	3·63	,,	I. of Man, Douglas	6·29
III.	Winslow, Addington ...	4·35	XII.	Stoneykirk, Ardwell Ho.	3·59
,,	Oxford, Magdalen Col...	4·57	,,	Melrose, Abbey Gate ...	4·76
,,	Northampton	3·92	XIII.	N. Esk Res. [Penicuick]	4·55
,,	Cambridge, Beech Ho...	3·40	XIV.	Ballantrae, Glendrishaig	4·00
,,	Wisbech, Bank House..	2·49	,,	Glasgow, Queen's Park.	2·33
IV.	Southend	2·37	XV.	Islay, Gruinart School..	2·30
,,	Harlow, Sheering	3·56	XVI.	St. Andrews, Pilmour Cot	3·78
,,	Rendlesham Hall	2·18	,,	Balquhidder, Stronvar..	4·03
,,	Diss	2·19	,,	Dunkeld, Inver Braan..	3·07
,,	Swaffham	2·67	,,	Dalnaspidal H.R.S. ...	4·82
V.	Salisbury, Alderbury...	3·29	XVII.	Keith H.R.S.	4·89
,,	Warminster	5·23	,,	Forres H.R.S.	3·58
,,	Calne, Compton Bassett	3·60	XVIII.	Strome Ferry H.R.S....	3·49
,,	Ashburton, Holne Vic..	4·71	,,	Tain, Springfield.....	2·64
,,	Holsworthy, Clawton...	3·44	,,	Loch Shiel, Glenaladale	4·87
,,	Hatherleigh, Winsford.	2·86	,,	S. Uist. Ardkenneth ...	1·25
,,	Lynmouth, Glenthorne.	3·96	,,	Invergarry	3·12
,,	Probus, Lamellyn	2·62	XIX.	Lairg H.R.S.	1·37
,,	Wincanton, Stowell Rec.	3·39	,,	Forsinard H.R.S.	3·13
,,	Taunton, Lydeard Ho...	4·95	,,	Watten H.R.S.	3·29
,,	Wells, Westbury.....	4·54	XX.	Dunmanway, Coolkelure	5·59
VI.	Bristol, Clifton	4·67	,,	Fermoy, Gas Works ...	3·26
,,	Ross	5·49	,,	Tralee, Castlemorris ...	2·98
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	3·60
,,	Cheadle, The Heath Ho.	5·60	,,	Newcastle West	...
,,	Worcester, Diglis Lock	5·84	,,	Miltown Malbay.....	3·37
,,	Coventry, Coundon	4·60	XXI.	Gorey, Courtown House	4·64
VII.	Melton, Coston	4·50	,,	Navan, Balrath	5·39
,,	Ketton Hall [Stamford]	4·92	,,	Mullingar, Belvedere ...	...
,,	Horncastle, Bucknall ...	3·80	,,	Athlone, Twyford	3·47
,,	Mansfield, St. John's St.	6·34	XXII.	Galway, Queen's Col....	4·60
VIII.	Macclesfield, The Park.	5·51	,,	Clifden, Kylemore	6·24
,,	Walton-on-the-Hill.....	4·53	,,	Crossmolina, Enniscoe..	5·11
,,	Lancaster, South Road.	...	,,	Collooney, Markree Obs.	3·99
,,	Broughton-in-Furness ..	6·96	,,	Carrick-on-Shannon ...	1·96
IX.	Wakefield, Stanley Vic.	5·13	XXIII.	Rockcorry.....	3·47
,,	Ripon, Mickley	4·94	,,	Warrenpoint	4·82
,,	Scarborough.....	4·01	,,	Newtownards	5·29
,,	East Layton [Darlington]	4·98	,,	Belfast, New Barnsley .	5·48
,,	Middleton, Mickleton ..	3·46	,,	Cushendun	2·64
X.	Haltwhistle, Unthank..	4·21	,,	Bushmills	3·04
,,	Shap, Copy Hill	5·08	,,	Stewartstown	3·82
XI.	Llanfrechfa Grange	7·81	,,	Buncrana	2·99
,,	Llandovery	6·09			

MAY, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	4·79	+ 2·87	1·27	24	19	75·3	7	31·6	1	1	6
II.		Maidstone (Hunton Court)...	2·72	+ ·70	1·13	12	16	...	...	...	...	...	...
		Strathfield Turgiss	4·40	+ 2·72	·91	12	21	73·9	9	29·3	4	4	6
III.		Hitchin	4·09	+ 2·10	1·01	12	18	72·0	8	26·0	1	2	...
		Banbury	4·75	+ 2·62	·87	12	20	72·0	7	30·0	1	1	...
IV.		Bury St. Edmunds (Culford)	2·75	+ ·85	·53	13	19	76·0	7	24·0	1	2	...
		Norwich (Cossey)	2·39	+ ·58	·57	13	17	74·0	7	26·5	1	2	3
V.		Weymouth(LangtonHerring)	2·51	...	·36	22	15	70·0	10	33·0	1	0	...
		Barnstaple.....	4·55	+ 2·45	·87	12	16	74·0	6*a*	33·5	1	0	...
		Bodmin	4·00	+ 1·16	·73	11	20	67·0	9	34·0	1	0	1
VI.		Stroud (Upfield)	4·90	+ 2·60	1·72	12	18	74·0	7, 9	37·0	13*b*	0	...
		ChurchStretton(Woolstaston)	9·49	+ 7·10	3·32	13	22	72·0	7	29·0	1	1	3
		Tenbury (Orleton)	7·11	+ 4·68	2·23	12	19	74·5	6	28·7	1	3	5
VII.		Leicester	4·90	...	1·01	13	19	...	...	...	...	...	...
		Boston	2·80	+ 1·03	·97	13	16	82·0	6	35·0	1	0	...
		Grimsby (Killingholme).....	3·86	+ 2·21	1·08	13	23	72·0	7	33·0	2	0	...
		Hesley Hall [Tickhill].....	5·56	...	1·65	13	24	76·0	6	29·0	2	...	...
VIII.		Manchester (Ardwick).....	5·52	+ 3·29	·70	12	23	71·0	7	36·0	1	0	...
IX.		Wetherby (Ribston Hall) ...	4·01	+ 2·19	1·08	13	12	...	...	...	...	...	...
		Skipton (Arncliffe)	6·33	+ 3·21	1·25	27	23	73·0	7	30·0	15	1	...
X.		North Shields	2·38	+ ·53	·89	27	19	71·5	6	29·0	2	1	2
		Borrowdale (Seathwaite).....	8·10	+ 1·12	1·91	27	20	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely)..	6·57	+ 3·97	1·53	13	18	...	...	...	...	...	...
		Haverfordwest	4·22	+ 1·53	·75	11*c*	18	68·0	6	30·0	1	2	11
		Plinlimmon (Cwmsymlog) ...	4·58	...	1·15	13	18	...	...	...	...	...	...
		Llandudno.....	4·18	+ 2·56	1·02	11	16	65·0	7	35·8	1	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	4·21	+ 1·68	1·38	27	18	69·2	7	34·2	13*d*	0	...
		Jedburgh (Sunnyside).....	3·41	+ 1·62	1·07	27	19	71·0	7	30·0	2	4	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	..	...	...
XV.		Lochgilphead (Kilmory).....	4·12	+ 1·36	·77	4	19	...	...	31·0	1*f*	6	...
		Oban (Craigvarren)	2·97	...	·69	17	18	68·5	23	34·0	1	0	...
		Mull (Quinish).....	2·47	...	·44	18	18	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·70	+ 1·41	1·00	21*e*	9	...	...	...	...	...	...
		Arbroath	2·63	+ ·86	·84	27	13	68·0	7*f*	33·0	1	0	...
XVII.		Braemar	4·83	+ 2·41	·81	20	20	64·8	7	24·0	2	6	13
		Aberdeen	4·10	...	·85	20	20	68·0	7	34·0	1	0	...
XVIII		Lochbroom	2·85	...	·61	27	20	...	...	...	...	...	...
		Culloden	3·29	+ 1·51	...	...	...	...	..	...	...	...	...
XIX.		Dunrobin	2·87	...	·70	14	15	60·0	22	31·5	1	1	...
		Kirkwall (Swanbister)..... ..	1·97	...	·60	20	20	54·6	5	30·9	31	...	...
XX.	IRELAND.	Cork (Blackrock).....	3·31	+ 1·15	·63	2	21	71·0	31	34·0	26	0	...
		Dromore Castle	4·74	...	1·35	5	15	70·0	30	33·0	12	0	...
		Waterford (Brook Lodge) ...	3·65	...	·57	23	21	63·0	31	29·0	1	1	9
		Killaloe	4·67	...	·64	23	21	67·0	22	32·0	1*g*	2	...
XXI.		Carlow (Browne's Hill)	3·75	+ 1·63	·87	11	21	...	...	...	...	...	...
		Dublin (FitzWilliam Square)	5·47	+ 3·75	1·27	12	21	67·4	5	35·8	1	0	5
XXII.		Ballinasloe	3·88	+ 1·47	1·06	11	21	63·0	5, 6	31·0	13*h*	3	...
XXIII		Waringstown	5·73	+ 3·62	2·05	12	22	72·0	6, 7	32·0	12	1	1
		Londonderry (Creggan Res.).	2·34	...	·30	10	21	...	...	...	...	...	...
		Omagh (Edenfel).....	3·32	+ ·97	·59	17	23	64·0	6	34·0	25	0	6

And 7, 10. *b* And 14. *c* And 13, 19. *d* And 16, 27. *e* And 28. *f* And 19. *g* And 13. *h* And 15.

+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON MAY, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The wettest May ever recorded here; agricultural prospects improved considerably by the heavy rains in the middle of the month, although in some districts there were floods; crops generally made good progress. TS on 19th.

BANBURY.—Mean temp. (50°·5) 2°·1 below the average; H on 15th; high wind on 11th and 12th.

CULFORD.—The temperature during May was very changeable, ranging from 76°·0 to 24°·0; everything was very backward at the close. T and L on 23rd and 30th; high wind on 17th.

COSSEY.—The shade temp. at 9 a.m. on the 8th, was 64°·0, the max. between noon and 1 p.m. 70°·5, and the reading at 9 p.m. 47°·0, showing a fall of 23°·5 in 8 hours.

LANGTON HERRING.—Rainfall ·73 in. above the average of 11 years; mean temp. (54°·4), 0°·8 above the average of 14 years. Here we quite escaped the floods and storms which prevailed in many parts of the country. TS on 31st; solar halos on 7th, 9th and 30th; fog on 16th and 23rd; very high wind on 27th.

BODMIN.—A month of singularly favourable weather. Mean temp. 53°·7.

STROUD.—A wet cold month; flowers and fruit very backward; T showers with H on 27th; high wind on 18th.

WOOLSTASTON.—After a week of fine dry weather the remainder of the month was very wet, the incessant downpour of the 12th and 13th being without precedent. The disastrous floods which resulted will long be remembered; several bridges (railway and other) were destroyed, and whole gardens with all their fruit trees were washed away. Mean temp. 50°·0.

ORLETON.—The weather was very fine and generally bright, with a temperature about 3° above the average till the 10th, when R commenced in the evening, and it became cold. Small R set in about 5 p.m. on the 11th, and continued almost without intermission for 64 hours, during which 4·64 in. fell. This produced the greatest flood on the river Teme since 1770. Much of the fall on the 13th was S which covered the Clee Hills and all the Welsh mountains, or the flood would have been higher. The remainder of the month was cold and stormy. Mean temp. nearly 2°·0 below the average; distant T on 20th, 25th and 29th; solar halo on 2nd; pear trees generally in blossom on 6th and apple trees about 23rd.

LEICESTER.—The weather after the first nine days was very cold and wet, rain falling on 19 days.

KILLINGHOLME.—The cold retarding weather which characterized April continued through May. After the first week there was scarcely a day without rain, and cold nights had injurious effects on the growing corn.

MANCHESTER.—The first week was warm and dry, after which the weather changed and became very cold, raw and wet, continuing so to the end, although towards the latter part the temp. rose slightly; the 12th and 13th were very stormy and cold, and altogether the weather was very unseasonable.

WALES.

HAVERFORDWEST.—May commenced as April ended, cold and ungenial; from the 11th to the 18th, a very stormy period occurred with rather low mean temp. The rainy character of the month told beneficially on grass lands, but otherwise hindered agriculture. The oak was in leaf a fortnight before the ash, though in some situations the difference was much less; white thorn was in blossom on the 25th, prevailing winds S.S.E., W., and N.W.

LLANDUDNO.—The mean temp. of the month (50°·7) was 2° below the average, and there was a wave of exceptionally cold weather on the 13th and 14th, the max. on the former date being 46°·0, and on the latter 45°·2 only. The month was ushered in by a moderate temp. of 50°·3, but on the 2nd it suddenly

rose to 61°·0, and continued to rise till the 7th, on which day 65°·0 was registered; on the 8th the temp. as suddenly fell to 55°·5, and did not again reach 60°·0 during the month. As regards range of temp. the daily (11°·9) was 2°·3, and the monthly (28°·0) 5°·2 below the average. There was no frost, but S was frequently seen on the distant hills. The most exceptional feature of the month, however, was its rainfall; for two days in succession (11th and 12th) there was a daily fall of over an inch, and on the 13th the fall was nearly half an inch, an occurrence which I have never before witnessed in Llandudno, the R being almost continuous and accompanied by a leaden sky and a strong cold wind from the E. Polar winds, N. and E. were perhaps more prevalent than usual, but were tempered to some extent by bright sunshine, of which there were 149 hours during the month.

SCOTLAND.

CARGEN.—The mean temp. (47°·7) is the lowest experienced in May for 26 years with the exception of 1869, when the mean temp. was 46°·8. The hills from about 800 ft. above sea level were covered with S on the 12th and 13th. The temp. of every month this year has been below the average; the mean for the five months being 3°·6 below the average. The rainfall has been 2·62 in. above, and the hours of bright sunshine 72 below the average. Solar halo on 7th; S, sleet and R on 12th; H on 16th; distant T on 30th.

JEDBURGH.—The weather of the month was generally very wet and cold; fruit blossom was nearly three weeks later than usual, and flowers in gardens were also late; grass lands late also, but owing to R looked fresh; night temp. low. Sleet showers fell during the 12th, and at night fully half an inch of S lay on the ground; high wind on 18th.

QUINISH—A cold, unsettled, backward month throughout.

BRAEMAR.—A cold month, vegetation being very much retarded.

ABERDEEN.—The weather throughout the month was very wet, showing an excess of rainfall of more than two inches over the average. Brilliant aurora was seen on the night of the 8th.

LOCHBROOM.—The coldest May on record; even while the sun shone the air was piercingly cold; S and sleet fell often in the valleys, and very frequently lay on the hills, and frost occurred almost every night.

IRELAND.

BLACKROCK.—A month of "many weathers," sometimes fine and bright, at others wet and cold, with H and distant T. Notwithstanding a late spring, vegetation made satisfactory progress. High wind on 17th.

DROMORE.—Very heavy H showers occurred during the month, and at times it was very hot; S on mountains in the middle of the month; vegetation made good progress.

WATERFORD.—A very cold and backward spring, with rainfall more than an inch above the average. Mean temp. 47°·7. The trees were dreadfully blighted by a S.W. gale on 17th, some of them losing nearly all their leaves on the side facing the wind. S on the Comeragh and Jaltee mountains on 15th; fog on 6th, 19th and 24th; H on 26th and 27th; corncake heard on 2nd.

KILLALOE.—The coldest May for ten years, the mean temp. (49°·9) being 3° below the average: rainfall much above the average.

DUBLIN.—A cold, unsettled, showery month with very heavy rainfall. Considering that May, on the average, is the driest month of the year in Dublin, the exceptional nature of the rainfall this month is thrown into bold relief, and a further noteworthy feature is the fact that more than an inch of R fell on each of two consecutive days, 1·15 in. on the 11th, and 1·27 in. on the 12th. This is altogether a phenomenal downpour for May. The other leading characteristics of the month were cloudy skies and N.E. or E. winds. Sleet on 12th; H on 14th, 26th and 28th; fog on 6th, 8th and 9th; solar halos on 1st, 6th, 7th and 16th; E. gale on 12th; high wind on 8 days. Mean humidity 81; mean amount of cloud 6·8.

EDENFEL.—The second week was remarkably cold, wet and inclement with strong drifting sleet, R and H; the mean temp. of the 11th and 12th was 38°·0 and 36°·0 respectively; with this exception the weather of the month was of the "wet and windy," and sufficiently mild character that promises abundant after-vegetation.

SYMONS'S

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CLIMATOLOGICAL RETURNS FROM JAPAN.*

THE first of the two works of which the titles are given below is wholly lithographed, the text being in parallel columns in Japanese and English. It is essentially an epitome of the daily weather maps issued by the Imperial observatory, and gives for each month maps of the tracks of low pressure and of high pressure centres, critical analyses of the forecasts issued by the observatory, and a list of gales reported from the Japanese lighthouses. It also contains an abstract of the observations at each of twenty-four stations for each month, and two maps for each month, one showing the distribution of pressure, temperature and wind, and the other that of rain. Finally, we have an abstract table for the year 1884, and two maps, one giving the isobars and isotherms for the year, and the other the total rainfall, which varied from 27·05 in. at Nemuro in the extreme N.E., to 109·80 in. at Kanazawa, near the centre of the mainland. The average fall at 25 stations fairly distributed over Japan was 63·98 in.

The second work is printed also in Japanese and English, and contains abstracts of the observations for the three years, 1883—85, from 27 stations well distributed over the country, and reaching from Nagasaki and Kagoshima in the S.W. to Nemuro in the extreme N.E., an area which may be roughly paralleled by one reaching from Madeira to Bordeaux.

The book consists almost wholly of tables, but considerable insight to the stations and arrangements may be obtained through these tables, *e.g.*, the majority of the barometers are at an elevation above mean sea level of less than 50 ft., and only, two, Kioto (161 ft.) and Nagasaki (189 ft.), exceed 150 ft. The thermometers are placed very uniformly, all being within twelve inches of 4 ft. above the ground, and most of them absolutely at that height. The rain gauges vary rather more ; the lowest is 7 in. and the highest 4 ft. 3 in. above the

* *Monthly Summaries and Monthly Means for the year 1884.* – 4to., 47 pages, 41 maps. Imperial Meteorological Observatory, Tokio, Japan, 1885.

Monthly and Yearly Means, Extremes and Sums for the Years 1883, 1884, and 1885. Published by the Imperial Meteorological Observatory, Tokio, Japan. 4to, 86 pages [Tokio, 1886].

ground. A column gives the date of establishment of each station, and from this we find that the oldest is that of Hakodate, which was started in July, 1872, Tokio was next in June, 1875, then Sapporo in September, 1876, and Nagasaki in July, 1878. There must, therefore, be some important mean values available, and we hope that ere long we shall receive an epitome of yearly abstracts for each station back to its very establishment.

It is, of course, impossible for us to give a tithe of the information contained in the volume, but we append a table which contains the most important facts for each station of which the record is perfect for the three years. We may mention that all values in the original are given in metric units and in centigrade degrees, but we have converted them all into English measures. We must call the attention of the director to one respect in which his tables are very irregular. He gives various extreme values, *e.g.*, the highest temperature in each month, and at the foot of the table he sometimes gives the absolute max. and sometimes the mean of all the max.; this is very apt to lead to error—the first is the correct value, and should have been alone given. The volume, of course, contains much information which we cannot here extract, but we may especially mention full details of the motion of cirri.

	Mean Pressure	Temperature.			Humidity	Cloud	Rain		
Years.	32° & S L.	Mean.	Absolute Max.	Absolute Min.	Mean.	Mean. 0—10	Total.	Max. in 24 hrs.	Days.
	in	°	°	°			in.	in.	
NAGASAKI, *Lat.* N. 32° 44′, *Lon.* E. 129° 52′.									
1883 ...	30·022	60·3	94·3	25·0	76	5·9	69·02	6·73	160
1884 ...	30·030	58·8	93 6	23·4	77	5·9	79·16	5·52	179
1885 ...	30·023	59·5	92·1	25·5	77	6·1	99·56	5·69	177
KAGOSHIMA, *Lat.* N. 31° 35′, *Lon.* E. 130° 33′.									
1883 ...	30·021	62·1	92·8	22·8	76	6·1	80·69	5·44	167
1884 ...	30 033	60·6	94·6	23·2	78	6·0	75 63	3·94	166
1885 ...	30·029	61·2	91·9	23·4	78	5·9	86 22	4·42	164
MIYASAKI, *Lat.* N. 31° 56′ *Lon.* E. 131° 26′.									
1883 ...	30·021	60·8	93·2	21·0	80	5·8	88·43	3·70	148
1884 ...	30·029	59·9	95·2	21·0	79	5·5	83·71	3·59	154
1885 ...	30·025	60·8	96·3	22·1	80	5·3	106·93	5·75	137
KOCHI, *Lat.* N. 33° 33′, *Lon.* E. 133° 34′.									
1883 ...	30·007	59·9	88·9	24·3	76	5·7	82·98	6·37	133
1884 ...	30·015	58 6	91·8	24·3	78	5·4	82·21	6·66	148
1885 ...	30·007	59·5	90·9	24·6	77	5 6	99·91	5·24	138
WAKAYAMA, *Lat.* N. 34° 14′, *Lon.* E. 135° 9′.									
1883 ...	29·997	58·8	97·9	22·3	73	6·4	46·89	5·12	134
1884 ...	30·005	57·6	92·5	24·8	73	6·3	54·48	3·98	149
1885 ...	29·993	58·6	92·5	24·4	74	6·2	67·39	5·09	147
OSAKA, *Lat.* N. 34° 42′, *Lon.* E. 135° 30′.									
1883 ...	30 009	57·7	96·1	22·3	76	6·4	42·05	3·65	111
1884 ...	30·017	56·3	93·2	21·0	77	6·2	56·73	5·18	132
1885 ...	30·004	57·9	94·6	23·2	76	6·2	63·09	4·43	145

Years.	Mean Pressure. 32° & S.L. in.	Temperature. Mean. °	Absolute Max. °	Absolute Min. °	Humidity Mean.	Cloud Mean. 0—10	Rain Total. in.	Max. in 24 hrs. in.	Days.
Kioto, *Lat.* N. 35° 1′, *Lon.* E. 135° 46′.									
1883 ...	30·005	56·3	97·2	20·1	76	6·8	45·34	3·40	146
1884 ...	30·009	55·2	93·0	15·4	78	7·0	62·38	3·84	157
1885 ...	30·005	56·1	92·1	15·8	77	6·9	71·14	4·10	174
Shimonoseki, *Lat.* N. 33° 58′, *Lon.* E. 130° 57′.									
1883 ...	30·028	58·6	96·4	24·1	77	6·2	58·12	3·92	163
1884 ...	30·032	57·2	91·6	26·8	78	6·5	66·55	3·74	163
1885 ...	30·024	57·9	90·9	27·5	77	6·1	73·60	3·43	179
Sakai, *Lat.* N. 35° 31′, *Lon.* E. 133° 13′.									
1883 ...	30·010	57·0	94·6	23·7	77	6·9	60·91	3·08	205
1884 ...	30·010	55·2	92·8	23·0	79	7·4	79·00	3·03	227
1885 ...	30·006	56·3	93·0	18·0	78	7·4	86·03	4·02	223
Kanazawa, *Lat.* N. 36° 33′, *Lon.* E. 136° 40′.									
1883 ...	30·005	54·7	92·5	20·5	79	7·6	94·15	2·85	215
1884 ...	30·005	53·6	94·8	21·0	79	7·9	109·83	2·52	236
1885 ...	29·997	54·3	93·9	18·7	80	7·6	129·96	3·56	237
Gifu, *Lat.* N. 35° 27′, *Lon.* E 136° 46′.									
1883 ...	30·001	56·7	96·4	18·0	79	6·2	59·74	4·85	132
1884 ...	30·009	55·4	93·0	10·9	81	6·1	75·28	5·62	148
1885 ...	30·005	56·3	91·6	14·2	80	6·6	95·04	5·91	158
Hamamatsu, *Lat.* N. 34° 43′, *Lon.* E. 137° 43′.									
1883 ...	29·980	58·6	97·3	22·8	75	5·0	58·32	2·76	128
1884 ..	29·967	57·0	94·5	25·0	76	5·0	65·24	4·92	121
1885 ...	29·963	57·6	92·5	22·6	75	5·2	90·90	4·55	148
Numazu, *Lat.* N. 35° 6′, *Lon.* E. 138° 51′.									
1883 ..	29·965	57·7	89·6	17·8	75	6·8	58·43	2·55	130
1884 ...	29·961	57·0	94·5	25·0	76	5·0	72·78	7·19	140
1885 ...	29·957	57·7	89·8	16·3	76	6·3	88·51	6·61	146
Tokio, *Lat.* N. 35° 41′, *Lon.* E. 139° 45′.									
1883 ...	29·973	55·6	91·2	18·0	77	5·9	56·09	3·48	141
1884 ...	29·969	54·9	92·1	18·3	76	5·8	51·74	3·23	125
1885 ...	29·969	55·4	89·1	15·6	77	5·9	60·54	5·99	146
Niigata, *Lat.* N. 37° 55′, *Lon.* E. 139° 3′.									
1883 ...	29·979	54·1	92·7	21·2	78	7·7	70·48	2·84	223
1884 ...	29·975	53·1	95·4	15·6	79	7·6	71·87	2·19	242
1885 ...	29·969	53·8	94·8	19·0	78	7·4	76·02	3·19	241
Akita, *Lat.* N. 39° 42′, *Lon.* E. 140° 7′.									
1883 ...	29·973	50·0	93·0	0·7	83	7·7	60·43	2·72	201
1884 ..	29·961	49·3	91·2	4·5	84	8·1	65·56	2·59	232
1885 ...	29·953	50·5	95·0	3·4	80	7·8	70·44	2·71	234
Aomori, *Lat.* N. 40° 51′, *Lon.* E. 140° 45′.									
1883 ...	29·949	47·1	89·8	—1·1	79	7·0	39·29	1·83	193
1884 ...	29·933	46·2	92·1	0·7	79	7·2	51·82	3·43	225
1885 ...	29·929	47·5	90·9	2·1	79	7·0	43·01	1·85	219
Hakodate, *Lat.* N. 41° 46′, *Lon.* E. 140° 44′.									
1883 ..	29·949	45·5	89·1	—0·6	84	6·5	31·41	1·71	129
1884 ...	29·929	44·6	84·0	1·9	82	6·9	43·19	2·37	166
1885 ...	29·917	46·2	82·9	—1·7	82	6·8	47·24	2·60	154

THE SONNBLICK OBSERVATORY.

THE highest meteorological station in the world is that on Pike's Peak, Colorado, which is situated at an altitude of 14,134 feet; the highest in Europe is now being erected on the Sonnblick, one of the heights of that portion of the Tyrolese Alps, the highest summits of which are the Grossglockner, the Wiesbachhorn, and the Hohe Narr. The Sonnblick (sun glance) is a mountain 10,170 feet high. Its summit is less difficult of access than those of some of its neighbours, and its suitableness for the erection of an observatory was first pointed out to meteorologists by Herr Rojacher, a gentleman owning the Rauriser Goldberg, whose private residence and mines are situate on the slopes of the Sonnblick at a height of over 5,000 ft. From this spot a wire rope way, used chiefly for the purposes of the mines, but also practicable for passengers, leads up to a height of nearly 8,000 ft. Here a house has been erected for about twenty miners, who reside there also during winter. Thence the summit of the Sonnblick is reached by an easy ascent over a glacier in three hours. The descent over this glacier may be made in low sledges in fifteen minutes.

The Sonnblick rises from the Rauris valley like a precipitous wall 3,000 ft. high, and the observatory now being erected on the summit, will consist of a blockhouse, flanked by a massive stone turret 40 ft. high. To guard against the frightful storms raging round the summit, the walls of the tower have been made of an enormous thickness, and the blockhouse is strengthened by being anchored to the rock by steel wire cables. Wood has been chosen for the construction of the house because it keeps out cold better than stone, the cold being most intense in mid-winter in that exposed position.

The house contains two living rooms—one for the resident observer, the other for such scientific men as may ascend during favourable weather with a view of carrying on their experiments. The walls of the house are panelled inside with wood, and covered neatly outside by wood shingles. The tower—the observatory proper—will be fitted with all the instruments used in meteorological science. As there is great danger to the building from the terrific thunderstorms which rage round the summit, the observatory is protected not only by three lightning rods, but also by a lightning-proof fencing. The solitary resident observer who has chosen to exile himself from civilisation for the best part of the year is one of the miners, who is now undergoing a course of instruction in meteorology. But he will not be cut off entirely from intercourse with his kindred, for he will be able to keep up communication by telephone with the miners' house 2,000 ft. below him, whence another telephone wire, 15 miles long, leads to Rauris. From the latter place, his daily record of observations will be telegraphed to Vienna and the scientific world generally.

It will be of interest to give, in the order of their altitude, a list of some existing high level stations re-arranged and corrected from one given by Dr. Breitenlohner, the director of the Sonnblick Observatory :—

14,134	ft.	Pike's Peak, Colorado, America.
10,170	,,	Sonnblick, Salzburgh, Austria.
9,512	,,	Etna, Sicily.
9,380	,,	Pic du Midi, Pyrenees, France.
8,360	,,	Valdobbia, Piedmont, Italy.
8,343	,,	Stelvio, Rhœtian Alps, Italy.
8,200	,,	Säntis, Appenzell, Switzerland.
7,091	,,	Monte Simone, Appenines, Italy.
7,087	,,	Little St. Bernard, Italy.
6,706	,,	Obirgipfel, Carinthia, Austria.
6,279	,,	Mount Washington, New Hampshire, America.
6,234	,,	Mont Ventoux, Cottian Alps, France.
6,100	,,	Wendelstein, South Bavaria.
5,827	,,	Schafburg, Ischl, Austria.
5,246	,,	Schneekoppe, Silesia, Germany.
5,139	,,	Pic de l'Aiglon, Cevennes, France.
4,823	,,	Puy de Dôme, Auvergne, France.
4,705	,,	Mont Pilat, Cevennes, France.
4,406	,,	Ben Nevis, Inverness, Scotland.
4,265	,,	Vesuvius, Naples, Italy.
4,259	,,	Briançon, Hautes Alpes, France.
3,990	,,	Ballon de Servance, Vosges, France.
3.747	,,	Brocken, Saxony.

The cost of the erection of the Sonnblick Observatory is, like that of most of the mountain observatories, to be defrayed chiefly by subscriptions, and the circular inviting such aid bears four signatures, which we reproduce, as they are sure to command respect and we hope support.

DR. JOS. RITTER v. LORENZ-LIBURNAU, k. k. Ministerialrath, *als Präsident.*
PROF. DR. FR. SIMONY, k. k. Hofrath, *als Vice-Präsident.*
PROF. DR. JULIUS HANN, Director der k. k. Centralanstalt für Meteorologie, *als I. Secretär.*
DR. STAN. KOSTLIVÝ, Adjunct der k. k. Centralanstalt für Meteorologie, *als II. Secretär und Cassier,* 38, Hohe Warte, Vienna.

We have never been strong advocates of mountain observatories, because we have waited for evidence upon two points : (1) We want to see how the records are going to be utilized ; (2) We want to know how the directors are going to overcome the difficulty which arises from the formation of hoar frost on the instruments.

We yield to no one in admiration of the courage and devotion of the observers up above the snow line, and shall be delighted to be convinced of the practical importance of their work. If Mr. Gaster would say that the Ben Nevis observations are of more use than would be a regular record from St. Kilda ; or if M. Fron would state that the absence of the records from the Puy de Dôme and the Pic du Midi would seriously diminish the accuracy of his forecasts for France, we should be most happy to insert their statements and accept their verdict.

There seem, however, to be several reasons why this Sonnblick Observatory merits special support: (1) If mere altitude is any recommendation, it has the merit of being the highest in Europe; (2) it is already built, and funds for its equipment and maintenance are alone required; (3) its central position will probably cause its records to be less interrupted by hoar frost than some other stations at a less altitude; (4) and chiefly, because the application bears the signature of Dr. Hann, and we know of no one so likely to thoroughly work up the records and to demonstrate the utility of mountain stations, or to show that they are merely "extremely interesting."

TEMPERATURE OBSERVATIONS ON LINCOLN CATHEDRAL.

By permission of the Dean and Chapter of Lincoln, the Council of the Royal Meteorological Society have recently made arrangements for a series of well-conducted observations to be carried on at Lincoln Cathedral to throw light on the vertical decrement of the temperature of the air. The great tower of the cathedral affords a good opportunity for carrying out these observations, as it rises to a height of about 300ft. above the ground, and of 500ft. above sea level. The instrument used for showing the temperature on the tower is one of the late Sir W. Siemens's electrical thermometers, which is placed on the N.W. side of the S.E. pinnacle. This electrical thermometer consists of a coil of wire wound round a cylindrical piece of wood inclosed in a small brass tube; a third wire is joined to one of the wires, and the three, insulated by gutta percha, form a light cable, which is brought down to one of the vestries of the cathedral and connected to a galvanometer, the terminals of which are in connection with the two poles of a six-cell Leclanché galvanic battery. The instrument is read by depressing a key, which causes the needle of the galvanometer to deflect; a pointer or vernier (moving a contact roller upon a wire in a circular groove) is then pushed to the right or to the left upon a divided scale until the needle remains stationary on the zero point, when the electrical resistance of the wire is measured upon the scale. The number indicated by the vernier is then read off, and by referring to a table of equivalents, the actual temperature in degrees of Fahr. is readily ascertained. A Stevenson thermometer screen with dry, wet, maximum, and minimum thermometers has also been placed in Mr. Mantle's garden, Northgate, for comparison with the electrical thermometer on the tower. All the instruments are under the care of Mr. Mantle, who will make frequent simultaneous observations during the day. The results of these experiments will be of great value in determining the variations of the temperature of the air at an altitude of 300ft. above the ground.

ROYAL METEOROLOGICAL SOCIETY.

THE concluding meeting of this Society for the present session was held on Wednesday evening, June 16th, at the Institution of Civil Engineers, 25, Great George Street, Mr. W. Ellis, F.R.A.S., President, in the chair. The Rev. J. R. Boyle and Mr. H. B. de la Poer Wall, M.A., were elected Fellows of the Society.

The following papers were read:—1, "Note on a Sudden Squall, January 13th, 1886," by Mr. R. H. Scott, F.R.S. This was an account of a remarkably sudden squall of about ten minutes' duration which passed over the south of England on the morning of January 13th. It was first recorded at Falmouth at 8.20 a.m. and passed over London at 10.40 a.m.

2. "The Floods of May, 1886," by Mr. F. Gaster, F.R.Met.Soc., and Mr. W. Marriott, F.R.Met.Soc. The month of May, 1886, will long be remembered for the heavy rains that occurred between the 11th and 13th, and the floods they produced over the greater part of the western and midland counties of England. In fact at Worcester the flood was higher than any that has occurred there since 1770. On the 11th and 12th heavy rain fell over the east of Ireland, there being over 3 in. during those two days at several places in Counties Down, Dublin, and Wexford; the greatest reported being 3·52 in. at Kilkeel, County Down. Over the other parts of the United Kingdom the rainfall on the 11th was under 1 in. Rain, however, commenced falling about noon on the 11th over the midland counties, and continued with increasing intensity till the morning of the 14th; the duration at most places being about sixty hours. The heaviest rainfall occurred in Shropshire, where over 6 in. fell at several stations, while at Burwarton as much as 7·09 in. was recorded; the amounts for each day being—0·60 in. on the 11th, 3·10 in. on the 12th, and 3·39 in. on the 13th. Very serious floods followed these heavy rains. At Shrewsbury the extreme height of the flood on the Severn was 16 ft., and at Worcester 17 ft. 1 in. above the average summer level. At Ross the flood on the Wye was 14 ft.; at Nottingham the rise of the water in the Trent was 12¼ ft.; at Rotherham the flood was 8 ft. 5 in.; and in north-east Yorkshire the Derwent rose to nearly 11 ft. above summer level. These floods caused great damage to property, and loss of life, bridges were washed away, railway traffic was suspended, and thousands of workmen were thrown idle. In several places the waterworks were flooded and the town's water supply was consequently cut off. Mr. Gaster drew attention to the complex character of pressure distribution during the time referred to, and showed how the region of maximum rainfall followed certain of the shallow depressions which appeared over the British Islands. He drew attention to the peculiarities of this type of depression, showing how in many, if not in most, cases the rainfall was heaviest in their rear, and was brought by the easterly, not by the westerly wind. He also referred to some

previous instances of heavy floods, in which similar atmospheric conditions prevailed, and explained how it was that as the disturbance passed off snow fell instead of rain, this in its turn being followed by severe cold, and in some places by frost.

3. "On atmospheric Pressure and its Effect on the Tidal Wave," by Captain W. N. Greenwood, F.R.Met.Soc. The object of this paper was to show how far a little knowledge of weather forecasting, with some practical knowledge of local weather changes, and a good barometer will go towards forming the right correction to be applied to the predicted height of the tide, and also to determine what that correction should be in its relation to the fluctuations of the barometer and the prevailing gradient.

4. "Meteorological Results at Levuka and Suva, 1875-1885, with Notes on the Climate of Fiji," by Mr. J. W. Vaughan, F.R.Met.Soc. The climate of Fiji is remarkably healthy. Diseases such as fevers of an aggravated and malarious character, cholera, and liver complaints are unknown.

DESTRUCTIVE WIND-STORM AT DEAL.

THE town of Deal, near which* about seven years ago a species of cyclone caused great damage, was again visited by a similar phenomenon on June 14th. During the whole of the morning the weather had been variable, with occasional heavy showers. There was very little wind, and just before the storm, shortly after mid-day, it was almost a calm, and oppressively hot. The first thing which was noticed as unusual was the peculiar appearance of the sky. A very long range of inky black clouds, of great density, stretched across the heavens, and advanced from a south-west direction. As if opposed to this, another similar bank, but shorter, advanced from the south. As these two sets of clouds approached each other some strange effects were witnessed. When within two miles of Deal they suddenly came to a standstill, and then changed their course and advanced together, crossing Deal from west to east. As soon as the ends of the clouds came together in the form of a fork the mass began twirling and dipping towards the earth in a spiral form. While it was perfectly calm and still at the time, in the south a terrific rushing sound, similar to the passing of an express train, could be heard proceeding from the clouds. At the same time the air became filled with straw and rubbish from stacks in the farmyards and such material as came in the path of the cyclone. As it passed over the town, causing great alarm, a large quantity of tiles was displaced where the wind caught the roofs of the houses, and on the beach it lifted many of the boats off the ground and carried them a considerable distance. Some of them were blown together two or three in a heap and damaged by the force of the collision, knocking out the greater portion of the gunwale of one of the craft. The wind-storm

* The Walmer Whirlwind, *Met. Mag.* Vol. xiii p. 145.

touched first the village of Sholden, near Deal, where it destroyed some vineries and nurseries. It caused great havoc to some farm buildings at middle Deal. Travelling eastwards across the South-Eastern Railway, the extraordinary force of the wind was manifested by its twisting a heavy iron crane, used for unloading railway trucks, round like a top. A tree was uprooted and blown into another garden. The storm lasted but a very short time, not more than ten minutes, and terminated in the Downs, where it had a curious effect on the water, but fortunately did not strike any shipping.

HEAT AND DRYNESS OF JULY 4TH.

To the Editor of the Meteorological Magazine.

SIR,—Last year I sent you the records of two very dry days —July 26th and August 17th—on which the difference of dry and wet bulbs reached 18°·9 and 17°·7. I now send that of one still drier, July 4th, 1886, the difference of dry and wet bulb reaching 22°·1.

I cannot say at what hour the excessive dryness began, as the readings at 9 a.m. not giving anything remarkable, I did not visit the screen again till my usual time at noon. The two following days were tolerably dry, the differences between the thermometers reaching respectively 16°·3 and 15°·9.

We have had only 0·44 in. rain since the 31st of May, and since the 19th of June only 0·02 in. (on the 22nd of June), and so are beginning to feel the want of it.—I remain, yours very truly,

R. H. BARNES.

Heatherlands, Parkstone, Dorset, 8th July, 1886.

4TH JULY, 1886.	Dry Bulb.	Wet Bulb.	Dew Point.	Relative Humidity.	Wind.		Cloud.	
					Direction.	Force.		
	°	°	°					
9 a.m.	75·5	66·6	60·2	59	N.N.W.	1	1	
Noon	84·4	64·0	50·6	31	N.N.W.	1 to 2	0	
1 p.m.	84·2	65·0	52·4	34	...	...	...	
1.30 p.m...	84·7	64 0	50·4	31	N.	1 to 2	0	
2.5 ,, ...	85·2	63·1	48·7	28	...	...	...	
2.30 ,, ...	85·9	63·9	49·6	29	...	..	...	
3.0 ,, ...	85·6	64·2	50·2	30	N.N.W.	2	0	
3.30 ,, ...	83·8	62·9	49·1	30	...	...	...	
4.0 ,, ...	83·5	63·6	50·4	32	...	...	...	
6·0 ,, ...	78·6	59·9	47·0	33	N.N.W.	2	0	
7·0 ,, ...	74·4	60·2	49·9	42	...	...	...	
8.0 ,, ...	69·1	58·1	49·5	50	...	...	...	
9.0 ,, ...	65·9	57·7	51·0	59	N.N.W.	1	0	
11.0 ,, ...	61·0	56·3	52·2	73	N.N.W.	1 to 2	0	Slight dew.

Max. in screen...	86°·1
Max. in sun, black bulb	126 ·4
,, ,, bright bulb	97 ·2

WHIRLWIND IN SOUTH-WEST LEICESTERSHIRE.

A SINGULAR phenomenon was witnessed in the neighbourhood of Croft and Whetstone during the progress of the storm on Tuesday evening, June 1st. Mr. Pochin, of Croft, states that while standing in his garden he noticed, coming apparently from the direction of Broughton Astley, a small black cloud, in shape like a corkscrew. It drifted towards Cosby and Whetstone, and during its progress another cloud, which resembled smoke, rose from the earth, carrying with it into the air a number of dark objects. The birds, which were caught in what proved to be a whirlwind, were thrown about like shuttlecocks, and the other objects seemed to be twirled about in all directions. On going over the ground on Wednesday morning, Mr. Pochin found that 40 or 50 trees had been either uprooted or stripped of their branches, which were scattered in all directions. One large ash was torn up and carried a distance of 18 feet, and an oak was uplifted and thrown a similar distance, whilst in a small field near Littlethorpe 10 trees were torn up by the roots. At Blaby, two massive trees on the Littlethorpe Road were thrown to the ground and dismantled, portions of the branches being carried for miles in the air.

REVIEW.

Serviciulŭ Meteorologicŭ in Europa. Note de călĕtorid de Inginerŭ ST. C. HEPITES. 4to, 164 pages. Tipografia Academici Romane, Bucuresci, 1884.

Istoricul Studilor Meteorologice in Romania, de ST. C. HEPITES. 8vo, 72 pages. F. Goble Fii, Bucuresci, 1886.

Observatiuni Meteorologice facute la Bucuresci in anul 1885, de ST C. HEPITES. Large 8vo, 124 pages. F. Goble Fii, Bucuresci, 1886.

TAKEN together, these three books give a fair idea of the state of meteorological work in Roumania, and we congratulate Director Hepites on his very business-like commencement.

The first-named work contains a full account of the meteorological organizations as ascertained by Dr. Hepites on a tour which, under the direction of the Roumanian Minister of Agriculture,* he made a few years since. The establishments visited and described were :—

England (Meteor. Office)	Holland (Utrecht)	France (Bureau Central)
,, (Kew)	Germany (Hamburg)	,, (Parc St. Maur)
Hungary (Budapest)	,, (Berlin)	,, (Montsouris)
Italy (Rome)	,, (Madgeburg)	Austria (Vienna)
Denmark (Copenhagen)	Switzerland (Zurich)	
Belgium (Brussels)	,, (Bern)	

The information thus obtained was of course invaluable as a guide to the formation of "The Meteorological Institute of Roumania," which is now in operation under Director Hepites.

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*Roumania *has* a minister for Agriculture, England has not yet reached that state of advancement!

The second work is also excellent as a preliminary to the work of the Institute. It comprises two parts, the first consisting chiefly of notices of, and reprints from, memoirs on meteorological observations made in Roumania (the first systematic record seems to be one for 1839-40 at Iasi [? Yassy, Lat. 47° 7′ N., Lon. 27° 28′ E.]), and the second part being a list, classified under the names of the authors, of books and memoirs upon the subject.

The third work contains the observations made daily at 8 a.m., 2 p.m., and 8 p.m. during 1885 at Bucuresci (Bucharest), printed *in extenso*. As it contains no summary for the year, we infer that it is merely a series of monthly reports stitched together, and that we shall ere long receive a complete yearly summary. Director Hepites has started well, and we wish him every success.

WEATHER FORECASTS AND SUN SPOTS.

Dr. Lonie, of St. Andrews, has lately drawn attention to some of the leading facts connected with the science of "weather forecasts" and with the theory of circular storms. He states that a strict examination of the records of the weather at Greenwich Observatory has conclusively proved that predictions based on the moon's changes are delusive. But in the matter of sun-spots the case is different. There is a remarkable concurrence of scientific opinion that the 11¼ years' cycle of their recurrences leads to increased solar radiation, of which we have our share in the form of increased evaporation and rainfall, and consequent development of cyclonic and magnetic storms. Such a law, if once established, would prove to be an important means of weather-forecasting over long periods, and, looking backwards over the more remarkable weather events of the century, he finds two witnesses equally for its truth and its value. It has been remarked that a mild winter in Europe often corresponds to a severe one in Asia and America, and that a mild winter in America corresponds to a severe one in Europe. The years 1816-17 were marked in the history of Europe by a general famine and distress. The wet was such that the harvests failed entirely. But the south-west wind which blew without cessation over the western part of the Continent, and which drenched it in its vapours, did not extend beyond Poland, and from the south of Russia came corn to support famished Europe. Again, many persons can remember the increased impulse given to the commerce between Europe and America by the drought of 1846, which damaged the corn crops in Europe, while America had an abundant harvest. Such facts forcibly illustrate the important part played in the life of nations by variations in atmospheric currents, and the examples adduced correspond with the periods of maximum sun-spots and minimum sun-spots compiled for the century by Dr. Wolf. According to Dr. Lonie we are again approaching just such another period of maximum sun-spots as happened in the year 1846.—*Engineering.*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DEC., 1885.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	50·8	4	22·3	11	44·0	33·8	35·3	87	72·2	15·4	1·05	11	6·2
Malta	69·1	9	40·6	14	60·5	51·0	47·0	77	118·7	34·8	2·35	12	5·2
Cape of Good Hope	..	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	84·2	9	69·0	31	82·2	73·6	69·4	78	139·5	58·3	5·16	20	7·2
Calcutta	80·6	18	50·2	27	75·3	57·8	57·4	76	139·7	41·0	·89	3	2·6
Bombay	88·3	26	65·0	3	83·4	69·5	64·2	67	142·0	53·1	·00	0	1·7
Ceylon, Colombo	90·8	2	72·0	26*a*	86·9	73·7	72·0	75	149·0	62·0	6·30	15	6·7
Melbourne	95·1	8	47·4	1	75·7	56·3	54·6	69	153·1	41·1	1·53	6	6·4
Adelaide	107·4	31	49·4	2	86·9	60·8	49·2	42	173·6	39·2	·46	5	3·7
Wellington	71·0	13*b*	43·3	6	66·4	52·5	54·9	86	145·0	40·0	1·01	6	4·7
Auckland	76·5	26	50·5	7	70·2	57·0	53·0	69	148·0	40·0	·55	7	7·1
Jamaica, Kingston	90·5	16	58·2	29	85·2	70·1	68·8	79	...	...	11·23	...	4·8
Barbados	82·0	2*c*	69·0	10	81·0	72·0	71·0	80	142·0	...	1·97	13	5·0
Toronto	43·6	9	—5·1	7	33·7	21·2	24·7	81	...	—10·5	1·98	16	8·4
New Brunswick, Fredericton	53·8	10	—8·2	18	30·8	10·2	19·4	85	...	...	4·13	15	6·4
Manitoba, Winnipeg	37·0	26	—25·3	6	17·6	—3·0	10·3	93	...	...	1·22	13	5·5
British Columbia, Victoria	57·0	2	24·0	31	47·6	38·0	...	...	...	...	2·47	13	...

(*a*) And 29. (*b*) And 20. (*c*) And 5, 28.

REMARKS, DECEMBER, 1885.

MALTA.—Mean temp. 54°·9; mean hourly velocity of wind 11·5 miles; sea temp. fell from 66° to 61°. TS on 15th; H on 11th and 15th. J. SCOLES.

Mauritius.—Rainfall ·17 in. below, and mean temp 0°·1 above, average; mean hourly velocity of wind 12·2 miles, extremes 28·1 miles on 23rd, and 1·6 miles on 26th; prevailing direction E.S.E. to E. L on 12th and T on 22nd. A cyclone passed E. of Mauritius from the 10th to 14th, and another N. and W. of Mauritius from the 18th to 24th. C. MELDRUM, F.R.S.

COLOMBO.—L on 1st, 3rd and 27th; T on 30th and 31st.
F. H. CLARKE, Lt.-Col. R.A.

Melbourne.—Mean temp. of air 2°·2 and of dew point 4°·4, mean humidity 5, mean amount of cloud 0·8, and mean pressure ·148 in. above their respective averages; rainfall ·86 in. below average. Prevailing winds S. and S.W., strong on nine days. T on 8th, 20th, and 22nd; L on 12th, 15th, 19th and 22nd; lunar halo on 21st.
R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 3°, and mean pressure ·077 in. above average; rainfall about half the average. W. E. COOKE.

Wellington.—Fine bright weather prevailed during this month, with very little rainfall in the early part, ·67 in. on the 7th being the max. for the month; from the 8th to the end it was excessively dry, and at times very warm; prevailing wind N.W., strong on five days, otherwise generally light. Pressure ·100 in. above, mean temp, (59°·4) 1°·6, and rainfall 3·07 in. below their averages. Earthquakes on 13th and 26th. R. B. GORE.

Auckland.—An unusually dry hot month, rainfall the lowest ever recorded for December. F. F. CHEESEMAN.

BARBADOS.—Mean temp. (76°·5) (1°·5) above, and rainfall 181 per cent. below, their averages; pressure very unsteady; mean hourly velocity of wind 12·2 miles, 25 per cent. above the average, extremes 17·1 miles and 4·5 miles.
R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, JUNE, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	·68	XI.	Castle Malgwyn	1·23
,,	Margate, Birchington...	·35	,,	Rhayader, Nantgwillt..	1·55
,,	Littlehampton	·63	,,	Carno, Tybrith	2·07
,,	Hailsham	·96	,,	Corwen, Rhug	2·13
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	2·32
,,	Alton, Ashdell.....	·73	,,	I. of Man, Douglas	1·30
III.	Winslow, Addington ...	·98	XII.	Stoneykirk, Ardwell Ho.	1·30
,,	Oxford, Magdalen Col...	1·14	,,	Melrose, Abbey Gate ..	1·22
,,	Northampton	·88	XIII.	N. Esk Res. [Penicuick]	1·45
,,	Cambridge, Beech Ho...	·35	XIV.	Ballantrae, Glendrishaig	·95
,,	Wisbech, Bank House..	·70	,,	Glasgow, Queen's Park.	1·04
IV.	Southend	·27	XV.	Islay, Gruinart School..	1·45
,,	Harlow, Sheering	·35	XVI.	St. Andrews, Pilmour Cot	1·26
,,	Rendlesham Hall	·21	,,	Balquhidder, Stronvar..	2·03
,,	Diss	·36	,,	Dunkeld, Inver Braan..	1·13
,,	Swaffham	1·40	,,	Dalnaspidal H.R.S. ...	2·05
V.	Salisbury, Alderbury...	·87	XVII.	Keith H.R.S.	1·70
,,	Warminster	1·23	,,	Forres H.R.S.	1·05
,,	Calne, Compton Bassett	·68	XVIII.	Strome Ferry H.R.S....	3·42
,,	Ashburton, Holne Vic..	1·07	,,	Tain, Springfield.....	·64
,,	Holsworthy, Clawton...	1·24	,,	Loch Shiel, Glenaladale	5·67
,,	Hatherleigh, Winsford.	1·26	,,	S. Uist. Ardkenneth ...	1·94
,,	Lynmouth, Glenthorne.	·91	,,	Invergarry	2·00
,,	Probus, Lamellyn	1·16	XIX.	Lairg H.R.S.	1·01
,,	Wincanton, Stowell Rec.	·57	,,	Forsinard H.R.S.	2·38
,,	Taunton, Lydeard Ho...	·74	,,	Watten H.R.S.	1·10
,,	Wells, Westbury.....	·74	XX.	Dunmanway, Coolkelure	1·38
VI.	Bristol, Clifton	1·02	,,	Fermoy, Gas Works ...	·68
,,	Ross	1·71	,,	Tralee, Castlemorris ...	1·10
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	1·53
,,	Cheadle, The Heath Ho.	1·39	,,	Newcastle West	·92
,,	Worcester, Diglis Lock	1·20	,,	Miltown Malbay.....	2·10
,,	Coventry, Coundon	·85	XXI.	Gorey, Courtown House	1·18
VII.	Melton, Coston	1·36	,,	Navan, Balrath	1·60
,,	Ketton Hall [Stamford]	·77	,,	Mullingar, Belvedere ...	1·55
,,	Horncastle, Bucknall ...	·69	,,	Athlone, Twyford	1·40
,,	Mansfield, St. John's St.	1·05	XXII.	Galway, Queen's Col....	1·38
VIII.	Macclesfield, The Park.	1·64	,,	Clifden, Kylemore	1·96
,,	Walton-on-the-Hill.....	1·10	,,	Crossmolina, Enniscoe..	1·37
,,	Lancaster, South Road.	2 01	,,	Collooney, Markree Obs.	2·12
,,	Broughton-in-Furness ..	2·34	,,	Carrick-on-Shannon ...	1·62
IX.	Wakefield, Stanley Vic.	·78	XXIII.	Rockcorry.....	1·76
,,	Ripon, Mickley	·79	,,	Warrenpoint	1·10
,,	Scarborough.....	·78	,,	Newtownards	1·14
,,	East Layton [Darlington]	1·20	,,	Belfast, New Barnsley .	1·44
,,	Middleton, Mickleton ..	1·57	,,	Cushendun	1·90
X.	Haltwhistle, Unthank..	2·37	,,	Bushmills	2·23
,,	Shap, Copy Hill	1·63	,,	Stewartstown	1·67
XI.	Llanfrechfa Grange	·64	,,	Buncrana	2·69
,,	Llandovery	1·90			

JUNE, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max Deg.	Max Date	Min. Deg.	Min. Date	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·63	— 2·04	·25	10	8	80·2	29	40·2	5	0	0
II.		Maidstone (Hunton Court)...	·26	— 1·81	·11	2	3	...	...	...	...	...	...
,,		Strathfield Turgiss	·60	— 1·50	·16	10*a*	11	79·7	29	37·7	5	0	1
III.		Hitchin	·94	— 1·19	·40	2	10	74·0	28	36·0	4	0	...
,,		Banbury	1·00	— 1·44	·36	2	10	78·0	29	42·0	4, 5	0	...
IV.		Bury St. Edmunds (Culford)	·77	— 1·50	·22	13	9	86·0	29	32·0	3	1	...
,,		Norwich (Cossey)	·50	— 1·72	·14	13	9	75·0	29	35·5	6	0	...
V.		Weymouth(LangtonHerring)	·71	...	·49	1	5	75·0	30	46·0	5	0	...
,,		Barnstaple.....	·83	— 1·89	·26	9	7	80·0	30	48·0	28	0	...
,,		Bodmin	1·12	— 2·09	·57	9	8	75·0	29*b*	47·0	7, 8	0	...
VI.		Stroud (Upfield)	·64	— 1·74	·25	1	9	82·0	28	47·0	20	0	...
,,		ChurchStretton(Woolstaston)	1·84	— 1·03	·60	9	13	74·0	28	43·0	3	0	0
,,		Tenbury (Orleton)	1·03	— 1·71	·50	1	12	80·3	29	39·0	21	0	0
VII.		Leicester	1·50	...	·89	1	10	78·6	29	38·2	4	0	4
,,		Boston	1·15	— 1·10	·87	1	5	87·0	...	42·0	...	...	...
,,		Grimsby (Killingholme).....	...	...	...	...	...	...	...	...	...	...	...
,,		Hesley Hall [Tickhill].....	·85	...	·34	1	6	78·0	29	37·0	4	0	...
VIII.		Manchester (Ardwick).....	1·65	— 1·51	·77	1	7	74·0	29	45·0	1, 3	0	...
IX.		Wetherby (Ribston Hall) ..	1·01	— 1·86	·61	2	3	...	...	...	...	...	...
,,		Skipton (Arncliffe)	2·40	— 1·42	·92	14	11	75·0	30	37·0	26	0	...
X.		North Shields	1·18	— ·85	·91	1	8	73·0	28	35·0	4	0	0
,,		Borrowdale (Seathwaite).....	4·70	— 3·11	1·73	14	11	75·5	30	39·5	3	0	...
XI.	WALES.	Cardiff (Ely).....	·75	— 2·31	·21	14	8	...	...	...	...	...	...
,,		Haverfordwest	1·66	— 1·37	·52	9	9	77·0	29	41·0	27	0	...
,,		Plinlimmon (Cwmsymlog) ...	2·10	...	·62	22	7	...	...	...	...	...	...
,,		Llandudno.....	1·21	— ·79	·66	1	8	70·1	30	...	...	...	...
XII.	SCOTLAND.	Cargen [Dumfries]	·52	— 2·65	·19	11	5	79·2	19	36·2	3	0	...
,,		Jedburgh (Sunnyside).....	1·98	— ·42	·92	1	9	72·0	28*b*	31·0	3	1	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	..	...	...
XV.		Lochgilphead (Kilmory)	2·00	— 1·84	·44	11	11	...	...	36·0	3	0	...
,,		Oban (Craigvarren)	1·52	...	·49	14	12	71·6	19	36·8	1	0	...
,,		Mull (Quinish).....	2·01	...	·51	14	17	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·10	— 1·67	·40	2	4	...	...	...	...	...	...
,,		Arbroath	1·14	— 1·47	·58	1	7	73·0	28	37·0	3	0	...
XVII.		Braemar	1·06	— 1·80	·30	15	12	72·0	30	30·0	3	1	3
,,		Aberdeen	1·01	...	·35	1	11	70·0	29	35·0	3	0	...
XVIII		Lochbroom	3·46	...	1·04	15	18	...	...	...	...	...	...
,,		Culloden	·71	— 1·54	...	...	...	71·0	30	35·0	3	0	3
XIX.		Dunrobin	1·91	...	·34	22	12	66·0	20	41·0	23	0	...
,,		Kirkwall (Swanbister)..... ..	2·21	...	·69	14	19	63·0	14	34·2	3	0	...
XX.	IRELAND.	Cork (Blackrock)	1·07	— 2·48	·34	9	8	82·0	29*b*	45·0	9	0	...
,,		Dromore Castle	1·87	...	·30	14	12	78·0	14	40·0	2	0	...
,,		Waterford (Brook Lodge) ...	·55	...	·13	2	8	76·5	29	45·0	24	0	0
,,		Killaloe	2·35	...	·64	8	16	80·0	30	40·0	1	0	—
XXI.		Carlow (Browne's Hill)	·81	— 1·85	·46	9	10	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·29	— ·91	·54	2	15	71·7	28	46·3	27	0	0
XXII.		Ballinasloe	1·30	— 1·89	·53	9	12	74·0	30	41·0	1	0	...
XXIII		Waringstown	1·42	— 1·24	·22	11	11	85·0	30	37·0	2	0	...
,,		Londonderry (Creggan Res.).	3·14	...	·90	8	16	...	...	...	...	...	...
,,		Omagh (Edenfel)	1·60	— 1·45	·85	8	13	75·0	30	38·0	26	0	...

a And 12 *b* And 30.

+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON JUNE, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather at first was very ungenial, and towards the middle of the month there was considerable R; the month ended with beautiful summer haymaking weather. TS on 19th. Wild rose in flower on 9th. Foxglove and honeysuckle on 22nd.

BANBURY.—Mean temp. (56°·4) 1°·8 below the average; high wind on 23rd.

CULFORD.—A very dry, hot month, and vegetation suffered much from want of R.

LANGTON HERRING.—A bright sunny month. Of the total R ·49 in. fell in one hour, from 9.10 a.m. to 10.10 a.m. on the 1st, and on the evening of that day there was a fog, which brought much blight on the apple trees. Mean temp. (60°·2) very nearly the average. Very fine weather prevailed in the latter part of the month, which was most favourable for securing the hay crop, which was heavy. Severe TS on 19th, solar halos on 5th and 17th, fog on three days.

BODMIN.—A singularly dry month; mean temp. 61°·8.

STROUD.—T on 1st, TS on 19th.

WOOLSTASTON.—A fine month for the hay harvest; mean temp. 56°·1.

ORLETON.—Much R fell on 1st and 2nd, with distant T, but the fall of R after, although frequent, was slight. The temp. from 1st to 23rd, was generally low and steady, but there were many bright days till the 9th, after which it was stormy and cold. The last week was fine and warm, with many brilliant days. Mean temp. about 1°·5 below the average of 25 years. Prevailing winds between N.E. and N.W., and frequently strong. Distant T on 5 days. All crops very backward.

ARDWICK.—Taken on the whole, June was fairly warm, but not hot, and fine and dry.

WALES.

HAVERFORDWEST.—A month of fine growing weather with gentle R and genial temperature, and at times windy; prevailing direction of wind W.N.W., and N.E. and E. during the last week with warm summer weather; excellent hay crops.

LLANDUDNO.—No storm or other very exceptional atmospheric phenomenon occurred. Mean temp. (55°·6) 2°·4 below average. There were a few warm days from 8th to 15th, but generally the weather was cold to the 23rd, when the max. temp. reached 60°·5; from that date the temp. gradually rose and culminated on the last day of the month in a max. of 70°·1; the total range (23°·9) was about 9°, and the mean daily range (11°·1) 3°·1 below the average. As regards R, the month did not sustain its proverbial character of a dripping June, but, on the contrary, was characterized by extreme dryness, nevertheless the crops suffered no detriment, the ground having been so thoroughly saturated by the excessive R of the previous month. The hay crop, as under these circumstances we had reason to expect, was a very heavy one, and much of it was secured in splendid condition before the close. Wheat and other cereals, though late, were promising in appearance and making rapid progress. Potatoes and green crops were also promising. The air throughout the month was singularly dry, and, though polar winds were prevalent, there was a large amount of bright sunshine (over 150 hours) to take the edge off their keenness. The public health was in all respects exceptionally good.

SCOTLAND.

CARGEN.—An unusually dry month. Mean temp. (54°·8) 1°·8 below the average. Great and sudden changes of temp. occurred, the range on the 19th

being no less than 36°·4. On two or three days about the middle of the month a strong parching wind from N.W. prevailed, doing much damage to the foliage, in many exposed situations making the trees as brown as in autumn. T and L on 9th and 10th.

JEDBURGH.—The weather of the month was generally cold and ungenial; the amount of sunshine was less than usual, and the night temp. was low. Cereals were backward and much in need of R at the close; turnip crops were well got in, and the hay got a good start with the R of the early part of the month, and looked well at the close. T on 9th.

OBAN, CRAIGVARREN.—The month was very cold for June, and there were great extremes of temp. H on 11th, 23rd and 24th. Half a gale on 12th and 24th.

QUINISH.—A cold ungenial month; vegetation very backward.

BRAEMAR.—A fine month with luxuriant growth.

ABERDEEN.—The weather of the month was fine on the whole; strong breezes prevailed from 15th to 21st, light variable winds both before and after these dates.

LOCHBROOM.—From the 10th, when a severe TS occurred, to the close there was very little sunshine, and not a day of summer warmth; the month as a whole was very cold, and occasionally stormy, hence everything at the close was weeks later than in an ordinary good summer.

CULLODEN.—An exceedingly dry month; R very partial.

IRELAND.

CORK.—Showery, between some fine days till the 11th, remainder of the month very fine and the last three days hot. Mean temp. 58°·7, 1°·5 below the average.

DROMORE.—A very fine month, the weather of the early part especially being very good for green crops, &c.

KILLALOE.—A lovely month with sufficient R and fine summer heat in the last fortnight; temp. in shade reached 79° on several days, and touched 80° on the 30th, with 57° as min. on the same date.

DUBLIN.—A month of average temp., N.W. winds and frequent, but scanty R. Cool squally winds blew on several days from points between W. and N.N.W.; at first these fresh winds were accompanied by showers, but after the 14th, only ·15 in. of R was registered on 4 days. The amount of cloud was usually large, but the last few days were characterised by brilliant weather and intensely hot sunshine. The mean temp. was very nearly the average, though the evenings were notably cold during the greater part of the month. The air was more or less foggy on 4th and 11th. High winds prevailed on six days, but there was no gale. Mean humidity 79; mean amount of cloud 6·3; prevailing winds N.W., W., and E.

OMAGH, EDENFEL.—The weather of the month was fresh, with deficient R and low temp. until the 29th, when a hot period set in.

ERRATA IN THE METEOROLOGICAL MAGAZINE 1885.

REGULAR TABLE.

Loch Leven Sluices, January *should be* 2·60. Arbroath, March *should be* 2·11.

SUPPLEMENTARY TABLE.

Dorking, Abinger, April *should be* 1·36. Wem, Sansaw Hall, Aug. *should be* 2·11.
,, ,, Aug. ,, ,, ·87. Wakefield, Stanley Vic., Oct. ,, 4·15.
,, ,, Sept. ,, ,, 5·47. Islay, Gruinart School, Dec. ,, 3·84.
Oct. ,, ,, 4·31.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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THE VOLCANIC PHENOMENA IN NEW ZEALAND.

WE have been favoured with such full accounts of the great seismic disturbance which commenced about 2 a.m. on June 10th as to cause an *embarras de richesses*. One of our New Zealand correspondents, besides his own personal narrative, has sent us various numbers of the *Wellington Evening Post*, with coloured lithograph views and maps of the district affected, and also the special edition of the *Auckland Evening Star*, with an eight page supplement crammed with lithographic reproductions of photographs, a map, and sketches of the disaster. Besides these there have been accounts (nearly all different) in most of the daily and weekly papers. We may, however specially notice the *Illustrated London News* of August 7th, *Nature* of July 29th and August 5th, *Science* (New York) of July 23rd, and the *Pictorial World* of August 5th. Of course by far the easiest course would be to pick out a series of paragraphs from these papers and re-print them, but that is not our notion of an editor's duty. What we have tried to do is to make ourselves acquainted with the various reports and statements, each of course reporting the facts merely as they appeared to one person from one place, and then to write the description in as near as we can chronological sequence, and as viewed from a safe height above the district, say four or five miles—below that, a blow from a piece of pumice might have been experienced.

Locality.—Near the intersection of the line of longitude 176° E. of Greenwich with that of 38° latitude S. and about 20 miles inland from the shore of the Bay of Plenty on the N.E. coast of the N. Island of New Zealand lies a district long celebrated as one of the wonders of the world. This is near the centre of an area of about 30,000 square miles, extending North-eastward from a mountain called Ruapehu (9,850 feet high), past Tongariro (7,800 feet), Lake Taupo with an area of about 200 square miles and 1,175 feet above sea level, crossing the valley of the river Waikato, and then coming on the gem of the whole, the hot springs and lakes of Rotomahana, Tarawera, Roto Rua, and Roto Iti, and the celebrated Pink and White Terraces.

Previous state —We give first one of the best general accounts which we can find :—

The physical formation of the whole region at once betokens its volcanic origin. In the centre was the beautiful lake Tarawera, whose winding shores were fringed by bold mountains with conical peaks, over which spread a rich growth of giant-like vegetation, while picturesque headlands, deep bays, broad valleys, and weird gorges came before the view at every turn. At the southern end of this lake, Mount Tarawera rose a thousand feet above the surrounding country in the form of a colossal truncated cone. From time immemorial it has remained in a quiescent state, until suddenly, as if awakened into a new life, it has sent forth its showers of ashes and rivers of mudlike lava for a distance of sixty miles over the surrounding plains. Mount Tarawera was, before the eruption occurred, connected with Lake Rotomahana by a bold range of volcanic hills, from whose valleys and sides issued at all times vast volumes of steam and sulphurous vapours. The lake itself, about a mile in diameter, with its hot green water, lay in the centre of towering mountains. Everywhere around one could see the wondrous workings of fire and water in the geysers, mudholes, and fumaroles that lined its shores. Every miniature island and jutting point had its cluster of boiling springs, every valley its waving cloud of steam, while the very waters of the lake sent up bubbles of heated gases from the depths below. In describing this curious lake, in his book on *The King Country*, Mr. Kerry-Nicholls states :—"We entered a rocky desolate gorge, seamed and fissured in every direction with streams of hot water, while jets of hissing steam bursting from its sides marked the site of subterranean fires. The heated quaking soil was covered with thick deposits of silica, sulphur, oxide of iron, pumice, obsidian, scoria, and other volcanic products, and with its sulphurous atmosphere, fierce heat, and shrieking sounds, it appeared as if we had entered by a short cut to Pandemonium. The high hills on each side of the gorge rose up in quaint fantastic shape, and their rugged sides, composed of shattered volcanic rock, sent forth water and jets of steam from a thousand fissures, while all the huge rocks, boulders, and stones had been pitched and tossed about by the tremendous action of fire and water into a wild and endless confusion. One of the most remarkable wonders of this region was Te Ana Taipo, or the "Devil's Hole," a deep circular aperture in the rocky gorge, from which a column of transparent steam burst from a small aperture at the bottom of the deep funnel-shaped hole with a deafening screeching sound like the voices of a thousand fiends. Never was heard anything so wild and so dismal as the human-like wailings of Te Ana Taipo ; and as the thrilling noise went echoing over the hills one expected to see an army of evil spirits spring up around, headed by his Satanic Majesty himself. We came suddenly upon Ngahapu, an intermittent boiling geyser, which burst forth with a loud noise from the farther side of an oval-shaped basin about a hundred feet in circumference, and in which the heated, steaming water, in a constant state of ebullition, kept rising and falling in great hot waves which lashed themselves into fury against the rugged sides of the cauldron with a loud hissing sound, as a column of boiling water shot high into the air. Right above this spring, on the side of a hill, a transparent jet of steam burst forth from a narrow fissure with a loud, screaming noise, as if anxious to escape from its rock-bound prison-house, and blow up the surrounding country. It blew, whistled, steamed, and hissed and shrieked away like a fifty horse-power engine, and the terrific pressure acting in some way upon the rocks below made them send forth a sound like the 'thud' of a great steam-hammer."

It was on the fiery borders of this remarkable lake, and on the slopes of fern-clad hills that sloped gently down to its brink, that the marvellous Pink and White Terraces, now unfortunately destroyed by the force of the eruption, delighted the beholder, as he gazed in wonder on their chaste and singular design. The same author thus writes of Te Tarata, or the White Terrace :—"As we looked upwards the whole outline of the terrace assumed a semicircu-

lar form, which spread out at its base in a graceful curve as it sloped gently down to the margin of the lake. Then broad, flat, rounded steps rose tier above tier, white and smooth as Parian marble, and above them terrace after terrace mounted upward, rounded and semicircular in form. All were formed out of a delicate tracery of silica, which appeared like lacework congealed into alabaster of the purest hue. Each lamination or fold of this beautiful design, was clearly and marvellously defined, and as the glittering warm water came rippling over them in a continuous flow Te Tarata sparkled beneath the sun as if bedecked with diamonds and myriads of other precious gems. Crystal pools, shaped as if to resemble the form of shells and leaves, and filled to their brims with water, blue and shining as liquid turquoise, charmed the eye as we mounted to every step, while around the edges the bright crystals of silica had formed encrustations which made them appear as if set in a margin of miniature pearls."

The crater of Te Tarata was formed of a milk-white circular basin of two hundred feet in diameter, filled to overflowing with brilliant transparent water. Here the hissing liquid in a constant state of ebullition bubbled and hissed in the form of a boiling fountain from which a waving cloud of steam floated constantly upward.

The Pink Terrace rose majestically from the shining green waters of the lake with rounded edges and waving curves, the buttress-like masses which supported the fringed edges of the terraces bent over and formed miniature grottoes, resplendent with festoons of pink-tinted silica and rose-coloured stalactites, which appeared to have been woven together by nature and crystallised into their present shape, while innumerable pools or salmon-coloured basins, all exquisitely and quaintly formed with curling shell-shaped margins, were resplendent with water of the purest and darkest blue.

The steaming cauldron was formed by a round alabaster-like basin about a hundred feet in diameter. Here the deep dark blue water, within a few degrees of boiling point, lay without a ripple upon its surface, which shone with the brilliancy of transparent crystal, and beneath which the silicious deposits which encrusted the sides of the crater assumed all the marvellous and fantastic designs of a coral grove, tinted in glowing colours of yellow, blue, and pink.

We need not add much to the foregoing except a few measurements, which may give distinctness to the description, all distances being measured in straight lines.

ROTO ITI, the most northerly lake, is about twice the breadth of Windermere and about its length, say two miles, from N. to S. and nine from E. to W. and at an average distance of 15 miles N.N.W. of Tarawera.

ROTO RUA, south-east of Roto Iti and almost adjoining it, is an approximately rectangular lake about five miles by four miles and 17 miles N.W. of Tarawera.

ROTO RUA township, on the south shore of the lake is the principal place in the district, and just 15 miles N.W. of Tarawera.

WAIROA.—The Maori settlement is about eight miles S.E. of Rota Rua, seven miles W.N.W. of Tarawera, and on a stream joining a little lake (Roto Kakahi, about two miles by one mile) to the large lake Tarawera, so called after the mountain which rises to the east of it.

TARAWERA lake is irregular in shape, but approximately square, and about 20 square miles in area. It was fed at the S.E. corner by two streams.

ROTO MAHANA, the most southerly lake which need be mentioned was a hot-water lake feeding Tarawera, and close to it were the Pink and White Terraces with which everyone who has seen them has been so charmed. These were about three miles S.W. of Tarawera.

We have, therefore, to picture to ourselves an area about equal to that of England from London to Hull and from Yarmouth to Hereford very thinly peopled, with many large lakes, many mountains of from 1,000 to 10,000 feet in height, all more or less volcanic in character, but nearly quiescent except an area of rather more than half the size of Leicestershire, where hot springs and lakes, geysers, and other phenomena gave constant proof of subterranean energy, yet as no violent eruption had occurred for many years none was expected.

The Outburst.—About 1 a.m. on June 10th the earthquake rumblings with which the residents are familiar gave place to more serious ones, and at 2.10 a.m. there was one of terrific force, after which a rush of fire and dust proclaimed the opening of Mount Tarawera as an active volcano. "In about an hour craters opened in and around Lake Roto Mahana and vomited enormous quantities of heavy mud, which with hardly conceivable rapidity spread disaster for miles round. Fifteen active fumaroles belching forth stones have been counted on the site of Roto Mohana, and one of the largest occupies the place where the Pink Terrace once was." The few buildings at Wairoa suffered severely, being crushed by the weight of mud thrown upon them.

Deaths.—The schoolmaster and four children were killed, and at one of the hotels a visitor shared the same fate. It is not known how many Maoris were killed, but certainly upwards of 100.

Darkness.—Tauranaga, 40 miles distant, was placed in total darkness by the thickness of the cloud of dust and ash, though the blaze of the volcano was visible in the S.E.

Dust.—It is not easy to distinguish between dust and mud, for great winds and rains were produced by the eruption, and after all mud may be but pumice dust mixed with water—but it is only at places near to Tarawera that this difficulty exists. Dust fell on vessels 130 miles away. At Tauranaga (40 miles) it was about $\frac{1}{4}$ in. deep; at Taheke (18 miles) 4 in.; at Te Ngae (15 miles) 9 in.; at Tikitapu (8 miles) 3 ft.; at Rotokakahi (6 miles) a 4 ft. fence was nearly buried.

Mud.—The area covered with indisputable mud seems to be about 15 miles square = 225 square miles, and over about 36 square miles it seems to have the enormous thickness of 20 to 30 ft. At Te Ariki it is said to be 20ft, and near Okaro lake 25 to 30 ft. The telegraph line man at Rotorua reported the wires to be coated with mud to the thickness of candles, and that the mud on the tops and insulators of each pole averaged 50 lbs. in weight.

Noise.*—The eruption was heard at Christchurch, 300 miles S.S.W of Tarawera.

* We have a note that the explosion was heard at Sydney at 11.50 p.m. Sydney time, which would correspond to about 1.30 a.m. at Roto Rua Sydney is, however, more than 1,000 miles distant.

Dust Column.—This was seen even from the other side of the island—from New Plymouth, distant 150 miles, the height of the top being estimated at 22,000 ft., or 4¼ miles.

Cuttings—We are indebted to the Hon. Minister of Mines for the following telegram, giving a complete analysis of the volcanic dust so plentifully distributed on the East Coast.—Silica, 62·2; alumina, 14·2; sesquioxide of iron, 6·2; lower oxide of iron, 2·3; oxide of manganese, trace; lime, 8·7; magnesia, 0·4; potash, 0·9; soda, 1·5; combined phosphoric acid, 0·04; combined sulphuric acid, 0·08; combined chlorine, 0·1; combined carbonic acid, 0·3; organic matter, 2·4; moisture, 0·4; total, 99·72. *Notes.* (1) Above 20 per cent. free angular quartz; (2) the phosphoric acid is low; (3) potash, fair proportion for soil; (4) lime, nearly insoluble, combined with silica; (5) no value as to dressing except to open heavy clay; (6) no permanent value as soil; (7) may from its state of fine division yield at first some benefit.—*Wellington Evening Post.*

"Latest accounts as to the New Zealand volcanic convulsions state that an area of 2,000 square miles is covered with three inches and more of dust. About 20 miles square is covered mostly to the depth of 3ft. and more. For 400 square miles at the outside the country is totally destroyed, and 1,600 square miles is much damaged, the result depending on the problem of the fertilizing qualities of the deposit."—*Melbourne Argus.*

Conclusion.—We venture, in conclusion, to congratulate our New Zealand fellow-subjects on two things: (1) on the vigour and ability of their newspapers; (2) on having in their service so skilled a geologist as Dr. Hector, F.R.S., whose instant despatch to the locality was a credit to the Government and a benefit to science. We cannot better conclude this note than by reproducing

Dr. Hector's explanation of the phenomena—

"The Tarawera mountain, which was formerly a volcano, had been for ages heavily capped with obsidian, forming, as it were, an enormous glass dome, hermetically sealing it. The pent forces have now blown this dome away. The tremendous explosion has shattered the tubes, or the piping of the pink and white terraces, which probably led thousands of feet into the superheated regions of the earth. This let down the whole of Lake Rotomahana, and generated an inconceivable body of steam, which simply blew the entire valley and the adjoining river into the air. What was formerly the lake is now occupied by numerous mud volcanoes, some of them 600ft. high and 300ft. across, belching forth mud and stones to a height of 100ft. or more. If this volcanic activity continues unabated, the district will, perhaps, afford in the future greater attractions to the tourist than even the vanished terraces, with all their matchless beauty."

A SHOWER OF SNAILS.

To the Editor of the Meteorological Magazine.

SIR,—Having heard that a fall of shell snails had taken place a few miles from here, I visited the place and found from a man who lived on the spot, that at about 9 p.m., just as it was nearly dark, what appeared to be a very black thunder cloud rose from the west,

and he went in for shelter. Next morning, on going to work, the roads, fields and stone hedges were plentifully strewn with small living shell snails, the fall extending over about three acres of land, but beyond these limits no shells were to be found.

What I saw myself perfectly corroborated what I was told, the fields being still thickly covered. I never saw shells of the kind in the neighbourhood before, though I have known it well for many years, and my informant told me that though he had lived on the spot 13 years, he had never previously seen that kind of shell there.

I am told by residents that there can be little doubt that the shells fell from the clouds, and unless this theory be correct it is most difficult to account for their sudden appearance in such vast numbers in a locality where they had never before been seen. They are apparently *Helix Virgata* and *Bulimus Acutus*. I enclose a few of the shells.

I shall be happy to give any other information in my power.

I am, sir, yours truly,
ALFRED HAMILTON JENKIN.

Trewirgie, Redruth, 9th August, 1886.

SEVERE FROST IN PORTUGAL.

SIR,—The weather at the commencement of the year 1766 was of such extraordinary severeity in Spain and Portugal, and so remarkable a hailstorm occurred at Gibraltar, that I think you will be interested with the following extract from a work entitled "The Marquis of Bombal," by the Conde da Carnota, second edition, page 252 :—

> My Hay writes : "We have had the coldest winter ever known in Portugal. The frost set in at Christmas, and lasted about six weeks. And General Irwin, then Governor of Gibraltar, in a despatch to the British Government, dated February 1st, 1766, gives a most astounding account of the effects of the season. Indeed, were it from a less authentic source, some little exaggeration might be expected. Towards night, on the 30th of last month, there fell so much hail that it ran down our rock with such violence, that many persons and cattle, and some houses, were destroyed by it. The drains being suddenly choked up, and the ramparts confining it, the lower part of the town is almost buried in it—many people suffocated in their houses—others escaped with difficulty out of their upper windows. It has done much damage, particularly made two breaches in our line wall, and, I fear, ruined many shop-keepers. I have, however, put everybody in motion, and hope to clear the town in a short time."

Faithfully yours,
R. STRACHAN.

11, *Offord Road, N.*
July 24th, 1886.

PARTICULARS OF THE FLOOD OF MAY 14th TO 16th, 1886, AS OBSERVED ON THE RIVER SEVERN BETWEEN STOURPORT AND GLOUCESTER, AND COMPARED WITH THE WINTER FLOODS OF 1770 AND 1852.

THIS flood, which attained a greater height at Worcester than any since the year 1770 was occasioned by very heavy rainfalls on the 12th and 13th of May, 1886, which extended over the whole of the Severn water-shed, and supervened on rainfalls which during the two previous days had been sufficiently heavy to fully saturate the ground.

The rainfall recorded during those four days, at the Diglis Locks, near Worcester, belonging to the Severn Commissioners, was over four inches in depth, whilst in some of the upper portions of the Severn water-shed nearly twice that depth of rain fell in the same period.

The river was but little affected by the rainfall up to the evening of the 12th, the height of the water in it being then only a few inches above ordinary summer level.

During that night, however, the water rose nearly ten feet, and by the morning of the 14th it had risen twenty feet above summer level, and reached its highest point (thirty-four feet two inches) on the lower Sill Lock gauge at Diglis at 2 a.m. on the 15th, being then about twenty-five feet above low summer level as marked on that gauge —3ft. 11in. above the top of the Lock walls, and about 2ft. 3in. deep over the ground floors of the Lock-keepers' houses there.

This flood in no part of the river between Stourport and Gloucester reached the level of that of November, 1770, though it was within a few inches of doing so at Diglis.

The flood line of May, 1886, accorded more nearly with that of November, 1852. Commencing at Stourport-bridge, the flood of 1770 was the highest, having reached 70ft. 3in. above ordnance datum at that point. Then followed the flood of 1852, 3ft. below that of 1770 whilst the flood of 1886 was 2ft. lower than that of 1852, or 5ft. lower than that of 1770.

Passing down the river, the lines of the three floods gradually converged until at a point about $10\frac{1}{2}$ miles below Stourport-bridge and $2\frac{1}{2}$ miles above Worcester, the lines of the 1852 and 1886 floods intersected each other at a level only about 21 inches below the line of the 1770 flood, which at that point reached 54ft. 8in. above ordnance datum.

From the last-named point the flood line of 1886, as compared with the others, gradually rose, whilst that of 1852 sank, until at Saxons-lode-bridge, which is situate about $25\frac{1}{2}$ miles below Stourport-bridge and which carries the Midland Railway between Tewkesbury and Malvern over the Severn, the relative heights were as follows:—The line of the 1770 flood (45ft. 10in. above

ordnance datum) highest, followed by that of the 1886 flood 15 inches lower, and then by the 1852 flood 18 inches below the latter, or 2ft. 9in. below the flood of 1770.

After passing Saxons-lode-bridge a rapid change took place in the relative positions of the three flood lines, as at Tewkesbury, 4 miles below Saxons-lode-bridge, or 29½ miles below Stourport-bridge, the lines of the 1852 and 1886 floods again intersected each other at a level about 2ft. 8in. below the line of the 1770 flood, which at that point reached 43ft. 6in. above ordnance datum.

From that point the lines of the 1852 and 1886 floods, whilst continually falling below that of 1770, were almost identical until the Upper Parting was reached—about two miles above Gloucester, or 40 miles below Stourport-bridge, and where the Severn divides into two branches, encircling Alney Island, and at this point the three flood lines read as follows :—

The 1770 flood line (42 ft. 1 in. above ordnance datum) highest, with the 1852 and 1886 lines about 5 ft. lower.

From this point into the tideway about a mile below Gloucester, the line of the 1886 flood fell below that of the 1852 flood. Their relative positions being as follows at the entrance into the tide-way :— The 1770 flood, (41 ft. 10 in. above ordnance datum) highest, followed by the 1852 flood, 6 ft. 6 in. lower, and then by the 1886 flood about 13 in. lower than that of 1852, or 7 ft. 7 in. below the line of the 1770 flood.

The flood of 1886 rose higher at Diglis than the flood of 1852, and continued higher down to Saxons-lode-bridge, because a railway embankment in connection with that bridge had been constructed across Upton Ham, between those two periods.

The 1886 flood overtopped the river banks immediately above that bridge some 3 or 4 ft., and whilst, prior to the construction of the railway embankment, the over-bank flood water had a clear and unobstructed course across the Ham, and so into the lower reaches of the river, those over-bank flood waters have had since the construction of the railway embankment to strain themselves through a very inadequate water-way left through the railway embankment across the backland drainage channel, and the over-bank flood waters were in consequence very considerably backed up over a wide area of flooded lands extending up the stream for a distance of from 12 to 15 miles above the bridge.

From this circumstance it is evident that engineers having charge of important water-ways troubled with over-bank-full floods must secure not only adequate sectional water-way areas for the main stream, but also for the free discharge of over-bank flood waters along the backland drainage channels.

The flood of 1886 subsided quickly—the traffic on the river having been suspended by it for a period of only four days, as compared with a suspension of 14 days following the flood of 1852.

Accurate daily gauge records of the height of the water have been

kept at various points on this section of the river for nearly 40 years, and they present many interesting features with respect to its behaviour in a great variety of circumstances.

Within the last few years rain gauges have been established at the various locks between Stourport and Gloucester, the records of which are taken daily, and more recently the temperatures of the air and of the water in the river also have been taken each day at various points in the river between Avonmouth and New Town, in Wales, so that a large amount of valuable and useful information on many points relating to the river will in course of time be accumulated.

HENRY J. MARTEN, M.Inst.C.E.
Engineer to the Severn Commissioners.

ON THE CLIMATE OF THE BRITISH EMPIRE DURING 1885.

ALTHOUGH we have now published for several years in succession, in a similar form the Climatological Table for the British Empire, some of our readers have probably not seen the earlier ones, and those who have, will not be uninterested in having some of the more striking facts brought to their notice; we will, therefore, just glance over the summary, and add a few jottings noted in preparing it.

The table this year shows a considerable increase in the number of stations available, and is very fairly representative of Her Majesty's Dominions with the unfortunate exception of the Cape of Good Hope, the returns from which are not complete for the whole year; the returns from the Falkland Isles are also incomplete.

Adelaide maintains its pre-eminence for extreme heat, and Winnipeg has resumed its position for the other extreme—of cold. It is curious, though not at all significant meteorologically, that the greatest heat should have been registered on the last day of the year, and the greatest cold on the first day. That these extremes should be registered at the stations named would probably be expected by most students of Meteorology, but probably few would be prepared to find that Winnipeg, with the lowest min. temp. in shade, and a mean temperature 0°·5 below freezing point, has a max. in shade higher than that at Mauritius, and less than three degrees below that at Bombay. The max. at Malta (103°·9) also appears high, exceeding that of Colombo, Ceylon, which is fully 25° nearer the equator, by 8°, and that of Bombay by 11°; it is, however, remarkably in accord with the max. temperatures at Melbourne and Adelaide, its position being roughly 30° N. of the equator, while they are 30° S.

Winnipeg, in addition to the lowest min. in the shade, records the greatest range of temp., nearly twice that of London, which follows the Canadian stations in order of greatness, and more than six times that of Barbados, which enjoys a remarkably equable climate as

regards almost all the meteorological elements. Next in order for range of temp. come the Australian stations, Malta, Calcutta, New Zealand, Jamaica, Bombay, Mauritius, Ceylon, and Barbados, with, as before stated, the smallest range.

We confess we are at a loss to understand the extreme dryness of Adelaide or to see why the difference between the mean relative humidity there and at Melbourne should be 15, while the extreme range for the same element, between all the other stations, is only 11; but the high standing of the directors of the two observatories precludes the possibility of the records being unreliable.

As regards max. in sun and min. on grass, little can be said, the conditions being necessarily such as to render the observations not fairly comparable. The appearance of Toronto for the lowest min. on grass is due to the absence of records at the other Canadian stations.

The total amounts of rain do not vary so much as might be expected, the limits of variation being considerably within those of England alone, but if we admit considerations of the rainfall of the Lake District as a basis of comparison, we ought also to take the fall on a wet spot among the Himalayas, when we should find the average of nearly 200 inches per annum at The Stye sink into insignificance.

The number of wet days also does not vary greatly, exceeding 100 at every station but one, and not exceeding 200 at any. The smallest, 63, is at our new station, Malta, which also has the clearest skies, the mean amount of cloud being only 2·9.

SUMMARY.

Highest temperature in shade: 107°·4 at Adelaide, on Dec. 31st.
Lowest temperature in shade: —46°·0 at Winnipeg, on January 1st.
Greatest range in year: 135°·8 at Winnipeg.
Least range in year: 21°·0 at Barbados.
Greatest mean daily range: 22°·7 at Fredericton.
Least mean daily range: 9°·5 at Barbados.
Highest mean daily temperature: 81°·1 at Colombo, Ceylon.
Lowest mean daily temperature: 31°·5 at Winnipeg.
Driest station: Adelaide, mean humidity, 56.
Dampest station: Barbados, mean humidity, 82.
Highest temperature in sun: 164°·7, at Calcutta.
Lowest temperature on grass: —19°·0 at Toronto.
Greatest rainfall: 85·58 inches at Colombo, Ceylon.
Least rainfall: 15·48 inches at Malta.
Most cloudy station: Melbourne, average amount 6·4.
Least cloudy station: Malta average amount 2·9.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1885.

STATIONS. *Those in Italics are South of the Equator.*	ABSOLUTE.				AVERAGE.					ABSOLUTE.		TOTAL RAIN.		AVERAGE.
	Maximum		Minimum.		Max.	Min.	Mean.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date	Temp.	Date.										
England, London	90·4	July 26	22·3	December 11	57·1	42·0	49·6	41·6	78	129·3	15·4	26·64	165	6·2
Malta	103·9	August 8	40·6	December 14	73·0	59·5	66·3	56·0	74	150·7	33·8	15·48	63	2·9
Mauritius	86·7	February 1	57·4	July 25	79·2	69·3	74·3	64·9	75	142·9	46 2	44·61	200	5·6
Calcutta	105·3	April 15	50·2	December 27	86·9	71·0	79·0	69·8	77	164·7	37·4	66 72	128	4·6
Bombay	92·7	June 8	60·6	February 11	85·3	74·4	79·9	71·2	75	153·2	48·4	67·91	113	3 6
Ceylon, Colombo.	95·8	February 22	68·8	January 2	86·9	75·2	81·1	72·2	75	150·0	59·5	85·58	194	5·8
Melbourne	101·6	February 5	29·9	July 15	66·2	49·2	57·7	47·2	71	157·6	21·1	26 94	123	6·4
Adelaide	107·4	December 31	35·0	July 15	72·0	53·2	62·6	46·4	56	173·6	26·3	15·87	133	4·8
Wellington	76·0	February 14	33·0	July 22	60·8	48·3	54·6	...	...	147·0	29·5	36·82	159	...
Auckland	79·0	February 14	37·0	September 11	64·6	52·2	58·4	49·2	71	149·0	29·0	28·14	155	6·1
Jamaica, Kingston	95·2	November 6	58·2	December 29	86·9	71·6	79·3	71·2	78	...	...	23·55	...	4·3
Barbados	86·0	September 26	65·0	February 12	81·2	71·7	76·5	72·9	82	149·0	...	46·26	173	5·3
Toronto	88·6	July 17	—16·1	January 22	49·5	32·6	41·1	36·0	77	...	—19·0	32·90	160	...
Fredericton	88·7	July 25	—23·2	February 12	50·6	27·9	39·3	33·1	76	...	...	45·09	144	5·1
Winnipeg	89·8	July 29	—46·0	January 1	42·6	20·4	31·5	29·2	81	...	...	16·52	121	5·4
Victoria	83·0	July 7	22·0	January 11	...	...	...	...	...	...	...	28·14	122	

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JAN., 1886.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	51·3	2	20·8	8	41·4	31·6	33·9	91	67·6	8·3	1·02	23	6·6
Malta	65·1	8*a*	41·1	11	59·7	48·8	46·2	81	116·9	37·2	5·24	16	4·8
Cape of Good Hope	101·0	27	50·2	9	85·2	59·9	58·6	66	...	...	·23	3	2·0
Mauritius	87·5	31	69·6	19	84·9	73·6	69·3	74	142·6	62·4	2·13	16	5·2
Calcutta	83·0	24	50·6	2	76·6	56·1	56·1	73	136·7	39·4	1·28	3	1·8
Bombay	86·2	5	62·0	30	81·3	67·8	62·5	67	139·8	50·1	·00	0	3·3
Ceylon, Colombo	90·2	7	69·0	3	86·6	73·0	70·7	73	153·0	60·0	2·43	10	5·5
Melbourne	100·0	5	48·3	12	78·3	57·9	56·2	68	147·4	41·0	4·54	10	4·9
Adelaide	112·4	4	50·8	31	86·9	65·0	51·9	43	174·5	43·9	·77	9	4·5
Wellington	79·0	25	45·0	2	70·2	54·7	54·3	75	145·0	44·0	4·92	9	4·0
Auckland	82·0	22	57·0	5	75·3	61·4	57·8	67	149·0	44·0	2·16	5	6·0
Jamaica, Kingston	87·6	8	62·2	26	84·3	67·0	66·7	78	...	...	3·48	...	3·9
Barbados	82·0	27	69·0	13*b*	80·0	71·0	70·9	60	144·0	...	1·13	10	6·0
Toronto	47·3	4	—13·8	12	25·9	11·4	19·2	85	..	—18·0	5·52	20	7·5
New Brunswick, Fredericton	42·9	6	—24·0	13	24·2	6·2	17·5	86	...	...	5·20	15	6·6
Manitoba, Winnipeg	24·2	13	—44·6	9	—5·3	—24·5	—10·0	98	..	...	·38	7	5·0
British Columbia, Victoria	51·0	13	17·0	21	38·7	30·9	..	...	..		3·84	13	..

(*a*) And 27. (*b*) And 14, 29. (*c*) And 5, 28.

REMARKS, JANUARY, 1886.

MALTA.—Mean temp. 53°·3 ; mean hourly velocity of wind 13·8 miles, unusually high ; velocity 34 miles per hour from noon to 3 p.m. on 1st. **TS** on 11th, **H** on 11th, 13th and 21st. J. SCOLES.

Mauritius.—Rainfall 3·47 in. below, and mean temp. of air 0°·4 above average ; mean hourly velocity of wind 10·8 miles ; extremes 23·6 miles on 15th, and 0·0 mile on 1st ; prevailing direction E.S.E. L on 8th, 9th, 22nd and 25th, T on 23rd and 26th, T and L on 11th and 24th. C. MELDRUM, F.R.S.

COLOMBO.—T on 19th. L on 8 days. TSS on 2 days. F. C. H. CLARKE, Lt.-Col.R.A.

Melbourne.—Mean temp. of air 1°·9, of dew point 3°·6, mean humidity 4, mean pressure ·049 in., and rainfall 2·86 in. above their respective averages ; mean amount of cloud 0·2 below average. Prevailing winds S.E. and S., strong on 5 days. T and L on 16th, 19th and 29th, T on 20th, L on 25th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure ·039 in. and mean temp. 1°·4 above average ; rainfall slightly below average. W. E. COOKE.

Wellington.—From 1st to 12th, fine, and at times very warm ; showery from 13th to 18th, then fine again until night of 25th, which with the 26th was wet ; fine on 28th, but heavy R on night of 29th ; remainder of the month showery. Prevailing winds N.W. and S.E. generally moderate. Rainfall 1·42 in., and pressure ·216 in. above average ; mean temp. 0°·1 below average. R. B. GORE.

Auckland.—The early and middle parts of the month were fine, warm and rainless, heavy R (1·20 in.) fell on 27th, and on 29th. Mean temp. and pressure above average, rainfall below it. T. F. CHEESEMAN.

JAMAICA.—Moderate shocks of earthquake were felt throughout the Island at about 9.30 p.m. on 1st. MAXWELL HALL.

BARBADOS.—Mean temp. (75°) 1°·5, and rainfall 256 per cent. above average ; pressure pretty steady ; wind N.E. on 30 days, and S.E. on 1 day, mean hourly velocity 9°·8 miles, about the average ; three days were more or less cloudy.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, JULY, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain
		in.			in.
II.	Dorking, Abinger	...	XI.	Castle Malgwyn	2·87
,,	Margate, Birchington...	1·87	,,	Rhayader, Nantgwillt..	5·89
,,	Littlehampton	2.55	,,	Carno, Tybrith	3·87
,,	Hailsham	2·68	,,	Corwen, Rhug	3·28
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	6·33
,,	Alton, Ashdell.....	2·26	,,	I. of Man, Douglas	4·93
III.	Winslow, Addington ...	3·90	XII.	Stoneykirk, Ardwell Ho.	2·93
,,	Oxford, Magdalen Col...	3·39	,,	Melrose, Abbey Gate..	3·18
,,	Northampton	3·39	XIII.	N. Esk Res. [Penicuick]	3·20
,,	Cambridge, Beech Ho...	3·17	XIV.	Ballantrae, Glendrishaig	3·16
,,	Wisbech, Bank House..	5·24	,,	Glasgow, Queen's Park.	1·79
IV.	Southend	2·76	XV.	Islay, Gruinart School..	4·23
,,	Harlow, Sheering	2·09	XVI.	St. Andrews, Pilmour Cot	3·64
,,	Rendlesham Hall	2·75	,,	Balquhidder, Stronvar..	4·77
,,	Diss	3·47	,,	Dunkeld, Inver Braan..	4·42
,,	Swaffham	5·16	,,	Dalnaspidal H.R.S. ...	4·36
V.	Salisbury, Alderbury...	2·10	XVII.	Keith H.R.S.	2·65
,,	Warminster	2·42	,,	Forres H.R.S.	2·17
,,	Calne, Compton Bassett	3·12	XVIII.	Strome Ferry H.R.S....	4·94
,,	Ashburton, Holne Vic..	4·59	,,	Tain, Springfield.....	2·04
,,	Holsworthy, Clawton...	2·43	,,	Loch Shiel, Glenaladale	...
,,	Hatherleigh, Winsford.	3·21	,,	S. Uist. Ardkenneth ...	2·70
,,	Lynmouth, Glenthorne.	2·67	,,	Invergarry	4·22
,,	Probus, Lamellyn	4·42	XIX.	Lairg H.R.S.	...
,,	Wincanton, Stowell Rec.	2·79	,,	Forsinard H.R.S.	2·75
,,	Taunton, Lydeard Ho...	2·68	,,	Watten H.R.S.	2·30
,,	Wells, Westbury.....	2·64	XX.	Dunmanway, Coolkelure	7·41
VI.	Bristol, Clifton	3·69	,,	Fermoy, Gas Works ...	3·69
,,	Ross	3·27	,,	Tralee, Castlemorris ...	4·91
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	4·73
,,	Cheadle, The Heath Ho.	3·73	,,	Newcastle West	3·51
,,	Worcester, Diglis Lock	2·93	,,	Miltown Malbay.....	4·60
,,	Coventry, Coundon	3.04	XXI.	Gorey, Courtown House	3·99
VII.	Melton, Coston	2·66	,,	Navan, Balrath	...
,,	Ketton Hall [Stamford]	3·69	,,	Mullingar, Belvedere...	3·23
,,	Horncastle, Bucknall ...	2·40	,,	Athlone, Twyford	4·37
,,	Mansfield, St. John's St.	3·05	XXII.	Galway, Queen's Coll...	5·12
VIII.	Macclesfield, The Park.	5·28	,,	Clifden, Kylemore	10·40
,,	Walton-on-the-Hill.....	4·42	,,	Crossmolina, Enniscoe..	4·52
,,	Lancaster, South Road.	5·56	,,	Collooney, Markree Obs.	3·33
,,	Broughton-in-Furness..	6·79	,,	Carrick-on-Shannon ...	3 41
IX.	Wakefield, Stanley Vic.	5·43	XXIII.	Rockcorry.....	3·76
,,	Ripon, Mickley	5·47	,,	Warrenpoint	3·45
,,	Scarborough.....	3·81	,,	Newtownards	3·50
,,	EastLayton[Darlington]	4·69	,,	Belfast, New Barnsley..	4·02
,,	Middleton, Mickleton..	4·36	,,	Cushendun	2·34
X.	Haltwhistle, Unthank..	5·68	,,	Bushmills	2·21
,,	Shap, Copy Hill	7·59	,,	Stewartstown	3·63
XI.	Llanfrechfa Grange	3·66	,,	Buncrana	3·29
,,	Llandovery	5·74			

JULY, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max Deg	Date	Min. D g	Date	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·37	— ·10	·66	25	11	87·5	4	44·4	28	0	0
II.		Maidstone (Hunton Court)...	2·14	+ ·10	·40	13*a*	13	...	...	...	...	...	...
,,		Strathfield Turgiss	2·00	— ·30	·43	25	13	85·2	6	44·3	1	0	0
III.		Hitchin	1·69	— 1·01	·64	25	13	80·0	4, 21	46·0	27	0	...
,,		Banbury	3·07	+ ·09	·86	25	14	85·0	4	45·0	9,16	0	...
IV.		Bury St. Edmunds (Culford)	3·55	+ ·58	1·21	25	15	90·0	6	40·0	8	0	...
,,		Norwich (Cossey)	...	...	...	...	...	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	2·53	...	·50	12	12	77·0	4, 5	46·0	28	0	...
,,		Barnstaple.....	2·66	— ·89	·52	11	12	79·0	19*b*	53·5	15	0	...
,,		Bodmin	3·71	+ ·27	·53	21	18	80·0	3	49·0	10	0	0
VI.		Stroud (Upfield)	3·29	+ ·45	·65	25	14	87·0	4	46·0	27	0	...
,,		ChurchStretton(Woolstaston)	2·71	— ·32	·65	13	19	80·0	3	44·0	28	0	0
,,		Tenbury (Orleton)	2·71	— ·20	·75	19	19	86·7	3	36·2	28	0	0
VII.		Leicester	3·74	...	·70	7	17	85·0	3	46·2	9,16	0	0
,,		Boston	3·06	+ ·53	·92	25	13	95·0	3,4	43·0	1	0	...
,,		Grimsby (Killingholme).....	...	...	...	...	...	...	...	...	...	...	...
,,		Hesley Hall [Tickhill].....	2·57	...	·64	23	16	82·0	2*c*	43·0	10	0	...
VIII.		Manchester (Ardwick).....	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ...	3·50	+ ·89	1·67	25	9	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·03	+ ·08	·92	11	16	83·0	2	36·0	9	0	...
X.		North Shields	4·32	+ 1·77	1·24	26	14	83·5	2, 4	39·5	28	0	0
,,		Borrowdale (Seathwaite).....	10·69	+ 1·92	2·04	13	18	79·5	3	45·5	28	0	...
XI.	WALES.	Cardiff (Ely).....	4·31	+ ·49	·82	11	17	...	...	...	...	...	...
,,		Haverfordwest	5·21	+ 1·28	·93	16	17	81·0	3	43·0	9	0	...
,,		Plinlimmon (Cwmsymlog) ...	6·64	...	1·10	11	22	...	...	...	...	...	...
,,		Llandudno.....	2·48	— ·23	·42	29	15	78·0	3	47·8	10	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·38	+ ·25	·65	13	15	78·8	1	39·8	14	0	...
,,		Jedburgh (Sunnyside).....	3·68	+ ·75	1·17	23	14	81·0	2, 3	40·0	10*d*	0	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	4·28	— ·26	1·10	13	18	...	...	35·0	8	0	...
,,		Oban (Craigvarren)	4·60	...	·91	13	22	78·5	1	41·9	9	0	...
,,		Mull (Quinish).....	4·27	...	·84	12	23	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·10	+ ·05	·90	26	10	...	...	...	...	...	...
,,		Arbroath	3·69	+ 1·05	·84	24	13	82·0	2	41·0	9	0	...
XVII.		Braemar	2·26	— ·60	·49	13 *e*	21	77·0	1	36·8	9	0	1
,,		Aberdeen	2·28	...	·46	13	18	81·0	2	40·0	9	0	...
XVIII		Lochbroom	3·33	...	·48	24	23	...	...	...	...	...	...
,,		Culloden	2·23	— ·55	...	...	...	79·0	1	36·0	9	0	1
XIX.		Dunrobin	2·35	...	·86	13	13	70·8	4	40·0	9	0	...
,,		Kirkwall (Swanbister)..... ..	3·12	...	·70	14	18	71·0	1	38·0	29*h*	0	...
XX.	IRELAND.	Cork (Blackrock)	5·14	+ 2·30	1·35	20	17	85·0	3	43·0	31	0	...
,,		Dromore Castle	7·66	...	1·50	16	17	70·0	2	51·0	31	0	...
,,		Waterford (Brook Lodge) ...	4·28	...	1·00	20	17	84·0	3	45·0	10*f*	0	0
,,		Killaloe	3·02	...	·86	25	20	80·0	1	47·0	10*g*	0	...
XXI.		Carlow (Browne's Hill)	3·00	+ ·44	·65	17	19	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·72	— ·70	·34	17	18	78·7	3	48·6	9	0	0
XXII.		Ballinasloe	3·06	+ ·18	·81	17	22	76·0	1	42·0	14	0	...
XXIII		Waringstown	3·46	— ·12	·56	28	19	85·0	1, 3	44·0	9	0	0
,,		Londonderry (Creggan Res.).	3·35	...	·47	13	23	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·71	— ·54	·58	13	22	79·0	1	40·0	27	0	...

a And 25 *b* And 20. *c* And 3, 4. *d* And 27. *e* And 24. *f* And 28. *g* And 14. *h* And 30.
+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON JULY, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The R which fell in the middle of the month was most acceptable to the crops and did an incalculable amount of good throughout the country, large areas of wheat being saved by it. Privet in flower on 1st, harebell on 2nd, mallow on 7th, convolvulus on 8th.

BANBURY.—Mean temp. 63°·5; T and L with heavy R on 25th.

CULFORD.—The temperature during the month was very variable, reaching 90° on the 6th, while two days later it fell to 40°. Crops generally were improved by the R, but the want of sunshine delayed the harvest.

LANGTON HERRING.—Rainfall ·24in. above the average of 11 years; no R fell from June 14th to July 11th. Mean temp. (63°·6) 0°·4 above the average of 14 years. Fog on 18th, 19th, and 25th; solar halo on 29th. On the 21st the sea, which is one mile distant, roared very loudly.

BODMIN.—The early part of the month was hot and dry, and the R which followed was very welcome. Mean temp. (64°·5) 2° above the average.

WOOLSTASTON.—A warm growing month, wheat crops at the close looking exceptionally well, but barley generally very indifferent. Mean temp. 59°·6.

ORLETON.—The first seven days were very bright and hot with the sky frequently cloudless. No R fell till the 11th, when the wind changed to S.W. and the remainder of the month was very showery with R almost every day, and much rough wind, greatly hindering the late hay harvest; the early hay crop was not an average, but was carried in fine condition without R. Distant T was heard on the 25th. Pressure was very unsteady after the 11th, but the fluctuations were not great. Mean temp. 0°·6 above the average of 25 years.

BOSTON.—During a TS on the 25th the L damaged Swineshead Church and several buildings in the neighbourhoood.

ARNCLIFFE.—On the 21st, ·50 in. of R fell in about 15 minutes during a TS.

NORTH SHIELDS.—Great heat prevailed from the 1st to the 7th; the weather from the 21st to the 31st was very unsettled and wet, and from the 25th unusually cold. TSS on 21st and 31st.

WALES.

HAVERFORDWEST.—The finest and warmest weather of this summer occurred during the first seven days of July, after which the weather was most precarious and uncertain, there being few fine days and the air being often chilly. The temperature on the whole was rather above the average owing to the excess of the first seven days. Late haymaking was seriously interfered with by R, and the harvest is likely to be a late one, though corn and green crops were looking well at the close. On ten days the temp. rose to or above 70°; mean temp 60°·3.

LLANDUDNO.—The first part of the month was bright and warm and without a single shower to the 9th inclusive; afterwards the weather was variable and unsettled and the wind was at times rather cold, especially in the evenings. Heavy T showers fell on the 21st, but without audible T, and the 26th was continuously wet; it was also very wet on the morning of the 29th. Though R fell on 15 days the total fall was about 8 per cent. below the average. The mean temp (59°·6) was 1·4 below the average; the range for the month (30°·9) was but slightly above the average, and the daily range (12°·1) was 2°·3 below it. There were only three days without sunshine and the aggregate amount (189 hours) was large.

SCOTLAND.

CARGEN.—Mean temp. (57°·7) 1°·9 below the average. The mean temp. of every month this year has been below average, viz., January 3°·9, February 5°·3, March 2°·9, April 1°·3, May 3°·2, June 1°·8, July 1°·9. T and L on 21st.

JEDBURGH.—The rainfall was considerably above the average of 20 years and there was unusual chilliness in the air. The want of R during the last half of June and the early part of July had a great effect on cereal crops, but the R later did much good and root crops looked well at the close. The harvest will be three weeks or a month later than usual even in the earlier districts. T on 3rd ; T and L on 24th.

OBAN.—An increased rainfall, well distributed over the month, brought forward the hay crop, which is plentiful, and white crops also are of fair quality and quantity. The temperature rose considerably during the month.

BRAEMAR.—A month of changeable weather.

ABERDEEN.—The most noticeable incident during the month was a grand auroral display on the night of the 27th, forming a corona at the zenith ; it is seldom that so vivid an aurora is seen in July ; in several places in Aberdeenshire the phenomenon was observed, and also in the outer Hebrides. The rainfall was slightly below the average. T and L occurred about midnight of 21st.

LOCHBROOM.—A month of cold and R, with sleet and S on the heights, and very little heat or sunshine, the temp. like that of spring and the R incessant. No grass was cut at the close and very little corn was in ear, indeed it promises to be a sad and late summer. The fishing is a failure.

IRELAND.

BLACKROCK,—Fine summer weather prevailed to the 10th almost without R, thence it was very changeable to the close with R on every day except six. Mean temp. (61°·2) 1°·5 below average. T on 20th.

WATERFORD.—A cold, wet month with rainfall 1·34 in. above the average.

KILLALOE.—Fair average weather and temperature.

DUBLIN.—Although it opened with brilliant, hot, summerlike weather, the month proved changeable, showery, and squally, with preponderating N.W. to S.W. winds. The contrast, as regards temperature, between the beginning and the close was very striking, the mean of the first seven days being 66°·1, while that of the last week was only 56°·2, a falling off of nearly ten degrees The rainfall, though distributed over as many as 18 days, was by no means heavy, and there was a complete absence of TSS. Prevailing winds N.W. and S.W., strong on 10 days ; solar halo on 29th ; fog on 2nd. Mean humidity 75 ; mean amount of cloud 6·6.

RAINFALL OF JULY 26TH, 1886.

To the Editor of the Meteorological Magazine.

SIR,—You will probably wish to know some particulars of the remarkable rainfall of the 26th ult. I am informed it commenced about midnight on the 25th ; it probably ceased about the following midnight, having been incessant, so far as I am aware, the whole day. The rainfall up to 8 a.m. on the 25th was 0·63 in. ; from that time up to 10.30 p.m., 1·46 in. fell, and the total set down to the 26th was 1·59, making a total of 2·22 in., the whole of which probably fell within 24 hours. I do not know that I ever measured so much in the time, but as it is divided between two rainfall days, it does not appear so heavy. With this great fall, the total rainfall from the 13th to the 31st of July was 4·84 in., following a remarkable dry period of 41 days, in which only 0·34 in. rain fell ; perhaps a drier period than I have before recorded of equal length.

T. W. BACKHOUSE.

West Hendon House, Sunderland.
6th August, 1886.

SYMONS'S

MONTHLY

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POLAR METEOROLOGICAL OBSERVATIONS.

In 1875, at the meeting of the Association of German Naturalists and Physicists at Grätz, Lieut. Weyprecht brought forward the subject of Polar research, dwelling on the geographical character of the great Polar expeditions and their scanty results as regards other branches of science, and proposing that several expeditions should be sent out to make simultaneous physical observations for a considerable period. The matter was further discussed at the Meteorological Congress at Rome, and ultimately an International Polar Committee was formed. After two or three meetings the programme was arranged, twelve stations were fixed upon, to be equipped by Austria, Denmark, England and Canada, Finland, Germany, Holland, Norway, Russia, Sweden, and the United States. France and Germany arranged to carry on observations on the borders of the Antarctic area, and the Italian Antarctic Expedition promised to co-operate. The period fixed upon was from August 1st, 1882, to September 1st, 1883.

The work, which we have now to notice* is the first volume of results which we have received, and contains the records at Fort Rae, the station equipped by England and Canada. It is essentially a volume of observations, and can be best described by printing some extracts from the Introduction, quoting here and there from the tables, and adding a few running comments.

"Fort Rae is one of the posts of the Hudson's Bay Company. It is situated in Lat 62° 38' 52" N. (only 11° north of London), and Long. 115° 43' 50" W., on a bay on the northern shore of the Great Slave Lake, and was selected for occupation as being the most northerly of the Company's posts from which return would be possible, after the termination of the observations before the closing of the rivers." It consists of "some half-dozen log huts, with a large store for provisions, furs and goods for trading with the Indians."

Fort Rae is the nearest of all the Company's stations to the magnetic pole, and it presents another advantage of a practical nature. Provisions at the post are usually plentiful, and this is by no means the case in all parts of the

* Observations of the International Polar Expeditions, 1882-3, Fort Rae. London, Trübner & Co., 1886 4to, xiv-326 pages, 32 plates.

country. To have taken a year's full supplies for the party would have materially increased the cost and difficulty of transport.

It was decided that the organization should be military, and Capt. Henry P. Dawson, R.A., was appointed to command the party."

While wishing to say nothing in the least degree depreciatory either of Captain Dawson, or of the three artillerymen who accompanied him, we cannot help expressing our regret at the prevalent impression in high quarters that meteorology consists in reading barometers and thermometers accurately and punctually, and therefore that any one who can do that is a competent observer. This volume affords much evidence of the want of some one of recognized standing as a meteorologist as *attaché* to the expedition.

The following was the equipment of instruments provided :—

2 Kew pattern marine barometers.
2 aneroid barometers.
2 small cup anemometers.
1 rain gauge.
10 mercurial thermometers.
7 spirit thermometers.
2 maximum thermometers.
2 maximum (solar radiation) thers.
4 minimum thermometers.
2 minimum (terrestial radiation) thers.
2 hair hygrometers.
2 tubes for earth thermometers.
1 zinc thermometer screen (Wild's pattern).
1 unifilar magnetometer.
2 bifilar magnetometers.
2 declinometers.
1 Lloyd's balance magnetometer.
1 dip circle.
1 6 in. transit theodolite.
1 6 in. sextant and artificial horizon.
1 prismatic compass.
1 chronometer watch.
1 spectroscope with camera (Capt. Abney's pattern).
2 cameras, with dry plates, &c.

The latitude, longitude and time were all determined with the transit theodolite.

The dry and wet bulb mercurial and spirit thermometers were placed in a zinc screen of Professor Wild's pattern, with their bulbs 5 ft. 10 in. (1·77 m.) above the ground. During the winter this height was reduced by 8 or 9 inches, owing to the accumulation of snow. The maximum and minimum thermometers, and a hair hygrometer were placed in the same screen. In February a wooden roof was added to protect the screen from the rays of the sun.

The rim of the rain gauge was kept at a height of 1 ft. (·32 m.) above the surface of the ground or of the snow. The solar radiation thermometer was placed vertically with the bulb uppermost, and 5 ft. 8 in. (1·72 m.) above the ground.

The terrestial radiation thermometer was supported horizontally by two forked sticks, with its bulb one inch above the surface of the soil. During the winter it was placed on the surface of the snow, as also was an ordinary spirit thermometer, whose readings were recorded hourly in clear and calm weather for comparison with the air temperature at the time.

The earth thermometers were fastened to a lath at intervals of one foot, and placed in a copper tube, which was sunk vertically in the ground. As the surface had a slope of one in sixteen to the S.W., and as it was cleared of vegetation, it no doubt received more of the sun's heat than a normal portion of the earth's surface in that latitude. There was but little choice of position, owing to the rocky nature of the soil, a circumstance which prevented observations of temperature being made at a greater depth than four feet. At first the thermometers were placed in the tube without any packing, but as the weather be-

came colder they were so rapidly affected by the temperature of the external air, on being withdrawn from the tube, that there was not time to record their readings before they began to change ; they were therefore, on the 4th of November, surrounded with strips of fur, and thenceforward the readings were much more regular. The fur, however, proved attractive to some beast of prey, probably a carcajou (wolverine), which on the night of the 11th of January managed to extract the thermometers from their tube, breaking them all. The observations were continued with other thermometers, which were coated with cotton wool, and no further interruption took place.

The position of the Observatory rendered it difficult to find a good position for the anemometer, on account of the hill to the north-east. Winds from this quarter were, however, rare, and the anemometer was well exposed to the prevalent winds, which were north-westerly and south-easterly. The estimated force by Beaufort's scale has been used in the reductions, a comparison having shown a close agreement with the anemometer readings.

There was little cloud in winter, and it was usually thin stratus and cirro-stratus, and did not appear to be at a high level. The S.W. wind was, however, attended with high cirrus clouds. A smoky haze was frequent in the summer, which was probably due to forest fires south of the lake.

Parhelia, paraselenæ, and haloes were of common occurence. On two occasions parhelia were observed at sunset between the observer and the opposite shore of the lake (distance four or five miles).

The prismatic colouring of cirrus and cirro-stratus clouds in the neighbourhood of the sun was frequently observed in the spring and summer, and was a phenomenon at times of great beauty. The colouring was once noticed to extend to a distance of 30° 40′ from the sun.

Aurora was observed on every clear night throughout the winter, as will be seen from the tables pp. 98-109. The journal of auroras has been printed *in extenso*, and the readings of the magnetic instruments at the time have been added, either as specimens of the disturbance that accompanies aurora, or where a marked change of reading has coincided with some phase of the phenomenon. The height of the aurora appeared to vary greatly ; it was twice noticed between the observer and a mass of cloud.

It was not found possible to obtain photographs either of the aurora or of its spectrum. Captain Abney suggests that this was probably due rather to the effect of the low temperature on the sensibility of the plate than to the faintness of the light of the aurora.

The first snow fell on September 27th, but it was not until a month later that the lake froze. The residents all agreed that the season was a very exceptional one, the winter being unusually mild, and late in setting in. At the end of November the Mackenzie River was still nearly free from ice, whereas it is usually full of drifting ice in October, and frozen over in November. There was also much less snow than usual. A party of Indians who came in on January 16th, reported that the country 50 miles to the N.N.W. was quite bare of snow, the ground being not even white. The winter was also unusually free from storms, which, from all accounts, and from the journal kept at the station, seem to be both frequent and severe in ordinary years."

What a pity not to have had a copy made of the notes in this journal which bore upon the local climate, and thus to have preserved

records of past years, and afforded the means of comparing 1882-83 with them.

"The snow began to disappear about the middle of April, and the ice to break up on June 3rd. By the 16th it had entirely disappeared from the neighbourhood of Fort Rae, though it was visible for some time longer on the horizon in the direction of the main lake.

The trees first showed signs of budding on May 16th, and on June 1st they were in full leaf; when the party left the place on September 1st they were already yellow and beginning to lose their leaves.

The observations being concluded, the return journey was accomplished without difficulty, and England was reached on November 20th, 1883."

The tables of atmospheric pressure give hourly readings for the whole period, the average being 29·357 in., and the range from 28·400 in. in November, to 30·342 in. in February. There is, however, no information as to the altitude above sea level, but it is not improbably upwards of 500 ft.

The tables of air temperature are similar, and we have considered them sufficiently interesting to compile the following summary:—

AIR TEMPERATURE.

		Mean. °		Max. °		Min. °
1882	September ...	6·9	.....	20·4	.....	— 3·7
	October	0·3	.....	12·7	.....	—12·1
	November ...	—12·6	.....	1·4	.....	—35·7
	December ...	—26·2	.....	— 4·7	.....	—39·7
1883	January	—32·7	.....	—15·6	.....	—44·6
	February ...	—23·6	.....	— 3·5	.....	—39·9
	March	—22·1	.....	— 8·3	.....	—39·9
	April	— 7·1	.....	7·4	.....	—23·7
	May	2·4	.....	18·5	.....	—17·9
	June	10·8	.....	24·7	.....	— 2·3
	July...	16·2	.....	24·7	.....	8·7
	August	13·6	.....	25·6	.....	3·3

Vapour tension and relative humidity come next with the same detail, but how far the observations are reliable at such low temperatures, it is difficult to say. There are numerous entries of humidity below 10, and the min. 4 at 6 p.m, on January 9th, occurs between values of 92 and 64, in a dead calm, and with a fairly steady shade temperature. It would be interesting to ascertain what became of the moisture present in the air the hour before and whence it came for the hour after this reading, and also why the observer made no remarks upon such a phenomenon.

The work throughout is rather lacking in explanatory notes and several useful details are omitted, among others, the height above ground of the anemometer. The results printed are the wind force, estimated by the Beaufort scale, as the readings of the anemometer were found to agree closely with these values. The second anemometer was erected on an island in the lake but was frequently stopped by snow drifting into the works. Probably this difficulty was also experienced with the instrument at the Observatory.

The monthly means of wind force are as follows :—

Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	August
3·0	2·9	2·4	1·5	1·4	2·4	2·1	2·3	2·5	2·5	2·7	2·6
4	0	0	0	5	16	0	0	0	0	0	0

The lower line gives the number of readings above force 10 in each month.

Forty-eight pages are devoted to the amount, form, and the direction of cloud, of which only the amount is summarized, and the tables are full of symbols, of which there is no explanation, and although the volume is evidently intended only for the use of advanced meteorologists, half a page of explanation to each set of tables would not materially have increased the size of the volume, and would, we think, have been useful.

The rainfall, or as it is wisely called the downfall, was apparently measured daily, and only yielded a total of 6·99 in. for the year in the following monthly amounts :—

Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	August
·43	1·01	1·10	·57	·19	·76	·04	·15	·24	·56	·74	1·20

There is no statement as to precautions taken to prevent snow drifting into the gauge, but with such strong winds as were frequent we think that some steps must have been absolutely necessary.

The hourly values of form and brilliancy of aurora, and observer's remarks on the display are very complete and valuable, and show a great frequency. The following summary is self explanatory :—

	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.
Period of Observation	7 p.m. to 4 a.m.	6 p.m. to 5 a.m.	5 p.m. to 7 a.m.	4 p.m. to 7 a.m.	5 p.m. to 7 a.m.	6 p.m. to 6 a.m.	7 p.m. to 5 a.m.	8 p.m. to 3 a.m.	11 p.m. to 2 a.m.	—	11 p.m. to 1 a.m.	9 p.m. to 3 a.m.
No. of Observations.	300	372	450	496	465	364	341	240	124	—	93	217
No. of Auroræ observed	99	107	145	218	220	169	226	103	16	—	13	76
No. of Days on which Auroræ occurred	25	22	26	31	31	27	30	26	11	—	9	28

The first line gives the period of the day during which hourly observations were made, observations of course being omitted during broad daylight ; the second line, the number of observations ; and the third, the number of observations at which the phenomenon was recorded, showing that during two-fifths of the time that it was dark enough for the phenomenon to be visible it was present, and that on only about one-fifth of the days of the year was it entirely absent.

By the way, the plural of aurora is printed *auroras*.

The readings of a black bulb max., *in vacuo*, are given for each day, but the observations are not worked up at all. The highest reading in sun is 60°·2, on June 23rd. Readings of a grass (or rather ground) min. appear in the same form, the lowest being 46°·7, on January 3rd, corresponding apparently with the reading of another thermometer on the ground which is stated to have read— 49°·6 at 9 a.m., on January 2nd.

In addition to this, hourly readings of a thermometer, exposed on ground, are printed in extenso, but we can find no description of the thermometer—whether bright or black bulb, mercury or spirit.

The observations of temp. of the ground at 1 ft., 2 ft., 3 ft., and 4 ft., were taken daily during part of the time and bi-daily during the remainder. In this table the — signs are partly inserted against each reading and partly given only at the top of the columns in a somewhat misleading manner, and several entries are in ( ), without any reason being assigned. The max. and min. at the different depths are as follows:—

Depth.	1 ft.		2 ft.		3 ft.		4 ft.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Temp.	11·6	—15·7	6·1	—9·0	3·9	—5·9	2·7	—4·6
	July	Jan.	Aug.	Jan.	Aug.	Mar.	Aug.	Mar.
Date	21	19	5, 7, 13	18	5, 11, 17	29 Apl. 1	17	31 to Apl. 9

After the meteorological records come nearly 150 pages of magnetic observations, hourly readings of the three elements, Horizontal Intensity, Declination and Vertical Intensity, very thoroughly worked up, and in addition, term day observations (which occurred twice a month), when readings were taken every five minutes. As these observations would not be of such general interest to our readers as those of the meteorological elements, we do not purpose going through them in the same manner.

The work, as a whole, is a store of observations of interest to every meteorologist in the world, and with the records of the other stations, will form a mass of material whose value cannot be estimated, and when the whole has been thoroughly discussed, as it no doubt will be by the International Polar Commission, we hope that our knowledge of the physics of the Polar regions will be greater than could have been obtained by isolated expeditions during hundreds of years.

WHIRLWIND AND WATERSPOUT IN SOUTH WALES.

The electrical disturbance which occurred in London on the morning of Saturday, September 4th, seems to have been very general, and other storms with even more unhappy results prevailed during the later hours of the day. Of these by far the most serious and alarming was that which during the afternoon was accompanied at Dowlais by a destructive whirlwind, and at Swansea by the bursting of a waterspout with terrible effect, amounting indeed in the suburb of Foxhole to the complete wreck of many homes though happily, as far as appears, without loss of life.

From the *Western Mail* we cull the following details :—

"At Dowlais terrible storms of rain, thunder, and lightning raged at intervals from an early hour on Saturday morning. The inhabitants were startled by terrific peals of thunder and torrents of rain which have seldom, if ever, been equalled in the district. Many low-lying places were flooded, but, comparatively speaking, the damage done was slight. About four o'clock in the afternoon a second frightful storm broke over the town, and for nearly an hour a darkness almost Cimmerian prevailed. Deafening peals of thunder, preceded by vivid flashes of lightning, were followed by a downpour of rain so heavy that objects could scarcely be discerned at a few yards distance. A remarkable phenomenon followed. Throughout the day there had been little or no wind, but almost immediately after the cessation of the rain-storm a violent whirlwind, moving in a southerly direction, passed suddenly over the town. Windows in many parts of the town were blown in, especially in Morlais Street, whilst hampers, crates, &c., standing outside greengrocers' shops were carried away. Several persons were blown down, and even a pony was blown over by the force of the whirlwind. It lasted only a few seconds, however, and for the rest of the night the storm subsided, only to break out again on Sunday."

At Swansea, the storm of the morning having given a hint of what was to follow, the weather brightened for a time until "at three the sky was again darkened by heavy clouds, most fantastically shaped, and for an hour a thunderstorm, accompanied by a perfect deluge of rain, prevailed. At both Swansea and the Mumbles vast streams of rain rushed down the hills with such velocity as to make deep watercourses in the centre of the roads.

But at Foxhole, a suburb of Swansea, what was elsewhere a torrent, took the form rather of an avalanche than that of anything else. This portion of the town is built at the base of Kilvey Hill, the highest eminence near Swansea, rising as it does 650 feet above the level of the sea. The side is almost as steep as a wall, but towards the base it slants somewhat, and here are rows of houses. There was a time when the side was covered with vegetation, but the fumes from the adjacent works having killed it there has been nothing to hold the earth together, and consequently a kind of rubble is all that keeps the rock from view. During the progress of the storm a waterspout was observed to travel from the bay in the direction of Kilvey Hill.

It burst, and immediately ensued a scene the like of which has probably never been seen in England. Great torrents rushed down the mountain side, cutting deep channels through which to pass, and carrying with it every obstacle, even to huge boulders weighing several hundredweight. These torrents or avalanches—for there were many of them—rushed down at a great rate to the first row of houses, and it is a curious fact that, though the walls of but few of these were demolished, the torrent never stopped, but, bursting in

back doors and windows, carried all the contents of the dwellings with it, while men, and women, and children were no more respected, there being cases where people were washed from a back room to a front room, out of the door, and down the hill to the houses below. Clothes and food, washed out in this unceremonious manner, were seen mingled with the earth which formed the avalanche, and hundreds of fowls, &c., accompanied them. Thus the earth continued its mad career till brought up at the base by a Midland Railway wall, the water continuing across the line—which was blocked for some time—till it found its level in the river.

All this time—half an hour elapsed from beginning to end—the most exciting and heartrending scenes were witnessed. Women and children were either dumb from fright or else screaming violently. Shrieks rent the air all round, and these mingling with the roar of the avalanche had an effect which was simply terrible. Mothers, at the imminent risk of their lives, rushed frantically in search of their children, and children, likewise, braved the dangers in order to find their parents.

Two children thus engaged were seen caught in the avalanche. In a moment one, aged only four, was buried in the *debris*, and the other would have suffered similarly had not Mr. Gwynne observed its terrible position. This one rescued, Mr. Gwynne endeavoured to save the other child. By the aid of a pickaxe, he succeeded, after great trouble and at the imminent risk of his life, in unearthing one limb after another, but not without himself being once dragged into the rush of earth and only saved with difficulty. Two little girls were in a front room. Down came the earth, the room was filled with great blocks of stone and rubbish, and the children well-nigh suffocated, when crash went the front door, and both children and *debris* were carried through a huge drain made by the rush of water. Their precarious position was observed by a man named Stephens, who, going to the rescue, also got caught in the current. The children clung to some rocks and were saved, but Stephens, notwithstanding the efforts of two men, who were also carried along with him, was washed a couple of hundred yards, and only escaped death by clinging to the top of a lamp-post against which he was dashed. His injuries are the loss of some fingers, while his arms are badly cut.

Another instance which illustrates the terrible force of the current of water and rock is the following:—A fishwoman was walking along the back of Foxhole Road, when she was caught, washed into a house, and, after the storm had subsided, people, attracted there by her screams, saw that she had been carried through the house into the front room, dashed into a corner, and covered up to the shoulders with the stones which filled every room in the house. In order to get her out, it was actually found necessary to use crowbars, so tightly was the earth forced into the room, and so heavy were some of the stones. The poor woman, who was in a fearful state, was at

once removed to the hospital. Several other people are also seriously injured, but, as far as can at present be ascertained, no lives have been lost."

It is estimated that altogether about 8,000 tons of earth and rock were carried down the precipitous sides of the mountain by this awful torrent. About 40 families have been rendered homeless, and as, from the condition of the hill side, there is reason to fear further devastation with the next heavy rain, a general exodus has taken place.

The extremely local character of the fall is proved by the fact that the three nearest rain gauges all collected less than two inches, viz., Swansea Dock, 1·13 in.; Penllergare, 1·73 in.; and Morriston, 1 93 in.

LAND AND SEA BREEZES.

To the Editor of the Meteorological Magazine.

SIR,—I write for information on a subject which may be well understood, but about which I am ignorant, viz., a circumstance connected with the alternation of land and sea breezes which occurs near the coast in fine weather. I have noticed here that there are various ways in which the change from one to the other takes place, and that there are certain ways which are most frequent. I have not counted the number of times each occurs, but my impression is that there are four ways which are especially frequent; of these I do not know which is the most common; they are the following:—

1st.—The wind is westerly at night and veers through N. to E., returning in the evening by veering through S. to W.

2nd.—The wind is N.W. at night, changes through N. to N.E. and back in the evening through N. to N.W.

3rd.—The wind is S.W. at night, changes through S. to S.E., and returns in the evening through S. to S.W.

4th.—The wind is westerly at night, and falls to a dead calm in the morning when the easterly breeze springs up, again falling to a calm in the evening before the west wind arises.

The second and third of these modes are evidently the result of a general tendency to blow from the N. or S. respectively. Besides these regular modes of change there are numerous irregularities of various kinds, but the reverse process to that of No. 1 very rarely, if ever, occurs. There must, therefore, be some reason to cause the tendency of the wind to veer rather than to back. The cause of this tendency may be, however, well known, and my enquiring about it simply shows my ignorance. If it is not known, the only reason that occurs to me to explain it is the position of the sun. It may be that the ground gets more rapidly heated towards the S. of the place of observation towards noon, owing to the sun's greater altitude there, and that in the evening it gets more slowly cooled towards the north

owing to the sun being then at a greater altitude on that side, and so a draught is produced towards the direction in which the ground is hottest.

I find the course of the wind here on a normal fine summer's day may be well represented on the following suppositions—that the duration of the land breeze from the dense air above the cooled land is rather longer than that of the sea breeze which blows in the day time towards the rarefied air above the land—that these breezes reach their greatest force a little after midnight and noon, gradually dying away in the morning and evening—that the breeze towards the sun reaches its greatest force at noon, and is imperceptible when the sun is below the horizon—that these three breezes are about equal in maximum force—and that they do not blow straight towards the rarefied air, but two points further to the right. Naturally I should have expected that the rarefied air towards the sun would not lie directly towards it, but that the heating effect of the sun upon the ground would take a little while to reach its height; and that its direction therefore would lag behind the direction of the sun, and its greatest intensity be reached after noon. Such a supposition, however, does not seem to satisfy the facts so well, unless we assume that the wind blows directly towards the region of lowest barometric pressure instead of to the right of it. The supposition that the land breeze lasts longer than the sea breeze may also be avoided if we make the additional supposition of a *general* wind from the west, which is not an improbable one.

But if the hypothesis of a breeze towards the sun is correct, it ought to be exemplified in places far inland. I should like to ask if any such tendency of the wind is to be observed at inland stations? I have never seen any mention of it in meteorological works, nor have I been able to find any explanation of the phenomenon in question. Loomis, in his "Meteorology," page 87, states that the diurnal change of temperature produces a sensible effect in modifying the direction of the wind; but the only example he gives is at Newhaven, which is on the sea coast, and all the change he mentions is that of the ordinary alternation of sea and land breezes. "B. S.," in the *Encyclopedia Britannica*, last edition, describes the way the wind changes on the Berwickshire coast, whereby it appears that it is much the same as here; but he does not give any reason why the wind veers rather than backs.

I should add that the coast here faces about the same way as the general direction of the east coast of England, viz., E.N.E.

T. W. BACKHOUSE.

Sunderland, August 30th, 1886.

A SHOWER OF SNAILS.

To the Editor of the Meteorological Magazine.

SIR,—I am sorry I have not been able to reply to your letter sooner, but am away from home. I am afraid I cannot give the information as to the shells being found in rain-water gutters, as I was not told of the occurrence until nearly three weeks after it happened, the farmer in whose fields they fell being of a somewhat uncommunicative nature, and hence the snails had crawled off the elevated places in order to get food, and moreover, there is no dwelling house within the limits of the fall. A correspondent states in one of our local papers that the ground in places was covered to a depth of three inches, and when I visited the locality, after a lapse of nearly three weeks, I should say there were from one to two thousand shells per square yard, but only within the small acreage of the fall.

I note what you say as to the abundance of the shells in Cornwall, and I may say that they are exceedingly plentiful on the sand hills on the coast, but they have never before been seen in the cultivated lands where the fall took place, nor indeed within many miles.

Had I been at home I should have visited the locality again, but under the circumstances, I am afraid at present I cannot give much more information.—Yours faithfully,

ALFRED H. JENKIN.

Tregullas House, Lizard, R.S.O., 14th August, 1886.

To the Editor of the Meteorological Magazine.

SIR,—In your number for the present month, you head a letter "A Shower of Snails." A respected correspondent, in answer to my request, writes thus:—

> "I am afraid I can give you no further particulars about the shower of frogs (at Lyston Hall, Suffolk). It was in the July of 1842 or 1843. They came down in a very heavy shower of rain; in fact, were you to insert "frogs" for "snails," the account in the magazine would be a correct description of what I remember. The gardeners were called to sweep up the frogs, and carried them away in *wheelbarrows*, and said they were *all* [the way] down the avenue. I have often told this, and have always been laughed at."

Yours faithfully,

SUBSCRIBER.

Dreghorn Castle, 24th August, 1886.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEB., 1886.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	47·7	13	19·4	10	38·4	29·5	30·8	87	82·6	14·7	·63	8	7·2
Malta	63·2	5	43·1	7	59·8	48·8	47·2	83	121·0	37·5	3·39	11	4·8
Cape of Good Hope	98·0	6	51·2	14	83·4	60·7	58·7	68	...	...	·00	0	2·6
Mauritius	88·4	1,11	71·4	4	85·7	74·2	70·3	75	143·6	64·1	4·26	18	5·3
Calcutta	91·5	27	46·7	6	82·1	57·9	54·6	63	146·0	35·2	·00	0	7·2
Bombay	86·6	12	58·1	3	82·0	67·0	62·4	67	142·3	45·9	·00	0	1·7
Ceylon, Colombo	93·0	24	67·0	4	89·7	72·3	69·6	68	148·0	56·2	·29	5	2·2
Melbourne	104·1	19	45·9	14	72·4	53·9	51·4	68	150·9	33·0	1·54	10	6·4
Adelaide	105·7	18	49·1	7	80·7	57·5	48·2	48	161·0	41·4	·36	4	4·1
Wellington	78·0	9	51·0	2	70·4	57·8	56·2	74	142·0	46·0	1·77	7	4·3
Auckland	81·5	8	58·0	12	76·0	62·2	58·2	69	153·0	48·0	5·02	13	6·7
Jamaica, Kingston	90·5	19	65·0	8	85·1	68·8	67·8	78	...	...	1·03	...	3·9
Barbados	81·0	10	67·0	15	80·0	70·0	69·3	75	144·0	...	·86	7	5·0
Toronto	41·7	9	—22·8	5	25·9	10·3	19·2	84	...	—27·0	3·08	18	6·7
New Brunswick, Fredericton	50·8	13	—17·3	5	25·8	5·5	15·5	79	...	...	4·66	15	5·7
Manitoba, Winnipeg	46·0	7	—41·6	3	12·3	—11·6	3·5	92	...	...	·50	7	5·0
British Columbia, Victoria	56·0	5	28·0	1	47·7	37·6	...	...	...	..	3·17	13	...

REMARKS, FEBRUARY, 1886.

MALTA.—Mean temp. 53°·7; mean hourly velocity of wind 11·3 miles; velocity averaged 36 miles per hour from 4 p.m. on 8th, to 8 a.m. on the 9th. A very heavy sea followed for 3 days. TSS on 5th, 6th and 10th. H on 6th. J. SCOLES.

Mauritius.—Rainfall ·65 in. below, and mean temp. of air 0°·7 above average; mean hourly velocity of wind 10·2 miles; extremes 26°·3 miles on 24th, and 1·9 miles on 17th. T and L on 5 days; T on 2; L on 3. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 3°·, of dew point 1°·8, mean pressure ·046 in., and rainfall ·44 in. below their respective averages; mean humidity 2, and mean amount of cloud 1·1 above their averages. Prevailing winds S.W. and S., strong on 6 days. A hot wind blew on 18th and 19th. L on 5th, H on 6th, dense fog on morning of 10th. R. L. J. ELLERY, F.R.S.

Adelaide.—By far the coldest February ever experienced at Adelaide; mean temp. 5° below average, and 1°·8 lower than any other in February since 1857. W. E. COOK.

Wellington.—Generally fine till 8th; heavy R on 9th with slight T; from 10th to 16th pleasant, with N.W. wind; from 17th to 19th dull and showery; ·66 in. of R being recorded on 18th, the max. for the month; the remainder of the month fine, bright and warm, with N.E. and N.W. winds, usually light. Altogether a fine month. Rainfall 1·78 in. below, mean temp (64°·1) 1°·6, and pressure ·022 in. above average. R. B. GORE.

Auckland.—A warm, damp month, with rather strong variable winds. Mean temp., pressure. and rainfall all somewhat above the average. T. F. CHEESEMAN.

JAMAICA.—The rainfall over the whole island was nearly twice the average. A shock of earthquake was felt at the western end on the 9th, and a slight shock at Kingston on the 20th. At Montego Bay the temp., which on 8th and 9th was 67°, fell on the morning of 10th to 56°, which is probably the lowest ever recorded there. MAXWELL HALL.

BARBADOS.—Pressure not steady, and ·06 in. lower than the average; mean temp. (74°·6) 1°·2 above the average. Prevailing wind N.E.; mean hourly velocity 13·7 miles, 22 per cent. above average; extremes 21·7 miles, and 9·8 miles per hour. Rainfall much below average. Four days were more or less cloudy. L on 28th. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·33	XI.	Castle Malgwyn	1·57
,,	Margate, Birchington...	1·45	,,	Rhayader, Nantgwillt..	2·71
,,	Littlehampton	1·13	,,	Carno, Tybrith	2·18
,,	Hailsham	1·53	,,	Corwen, Rhug	1·25
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	3·17
,,	Alton, Ashdell.....	1·43	,,	I. of Man, Douglas	2·52
III.	Winslow, Addington ...	1·89	XII.	Stoneykirk, Ardwell Ho.	3·56
,,	Oxford, Magdalen Col...	1·65	,,	Melrose, Abbey Gate ...	1·42
,,	Northampton	1·76	XIII.	N. Esk Res. [Penicuick]	2·25
,,	Cambridge, Beech Ho...	2·73	XIV.	Ballantrae, Glendrishaig	2·57
,,	Wisbech, Bank House..	1·74	,,	Glasgow, Queen's Park.	1·70
IV.	Southend	...	XV.	Islay, Gruinart School..	2·69
,,	Harlow, Sheering	1·14	XVI.	St. Andrews, Pilmour Cot	1·13
,,	Rendlesham Hall	1·35	,,	Balquhidder, Stronvar..	3·54
,,	Diss	1·29	,,	Dunkeld, Inver Braan..	1·22
,,	Swaffham	2·84	,,	Dalnaspidal H.R.S. ...	2·17
V.	Salisbury, Alderbury...	1·01	XVII.	Keith H.R.S.	1·86
,,	Warminster	1·20	,,	Forres H.R.S.	1·12
,,	Calne, Compton Bassett	1·37	XVIII.	Strome Ferry H.R.S....	3·79
,,	Ashburton, Holne Vic..	3·01	,,	Tain, Springfield.....	1·08
,,	Holsworthy, Clawton...	1·86	,,	Loch Shiel, Glenaladale	6·76
,,	Hatherleigh, Winsford.	2·04	,,	S. Uist. Ardkenneth ...	2·65
,,	Lynmouth, Glenthorne.	2·08	,,	Invergarry	3·30
,,	Probus, Lamellyn	2·06	XIX.	Lairg H.R.S.	·90
,,	Wincanton, Stowell Rec.	1·35	,,	Forsinard H.R.S.	2·39
,,	Taunton, Lydeard Ho ...	1·63	,,	Watten H.R.S.	2·59
,,	Wells, Westbury.....	2·23	XX.	Dunmanway, Coolkelure	5·92
VI.	Bristol, Clifton	2·39	,,	Fermoy, Gas Works ...	2·37
,,	Ross	1·46	,,	Tralee, Castlemorris ...	3·68
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	2·87
,,	Cheadle, The Heath Ho.	1·71	,,	Newcastle West	2·75
,,	Worcester, Diglis Lock	1·64	,,	Miltown Malbay.....	3·88
,,	Coventry, Coundon	1·85	XXI.	Gorey, Courtown House	2·30
VII.	Melton, Coston	2·11	,,	Navan, Balrath	3·17
,,	Ketton Hall [Stamford]	1·72	,,	Mullingar, Belvedere ...	2·37
,,	Horncastle, Bucknall ...	1·97	,,	Athlone, Twyford	2·51
,,	Mansfield, St. John's St.	1·69	XXII.	Galway, Queen's Coll...	3·43
VIII.	Macclesfield, The Park.	2·91	,,	Clifden, Kylemore	6·82
,,	Walton-on-the-Hill.....	1·69	,,	Crossmolina, Enniscoe..	2·80
,,	Lancaster, South Road.	1·96	,,	Collooney, Markree Obs.	3·08
,,	Broughton-in-Furness ..	2·42	,,	Carrick-on-Shannon ...	2·98
IX.	Wakefield, Stanley Vic.	1·41	XXIII.	Rockcorry.....	2·33
,,	Ripon, Mickley	1·90	,,	Warrenpoint	1·95
,,	Scarborough.....	1·82	,,	Newtownards	2·15
,,	East Layton [Darlington]	1·45	,,	Belfast, New Barnsley .	3·23
,,	Middleton, Mickleton ..	1·13	,,	Cushendun	1·87
X.	Haltwhistle, Unthank..	1·24	,,	Bushmills	2·02
,,	Shap, Copy Hill	2·32	,,	Stewartstown	2·25
XI.	Llanfrechfa Grange	1·79	,,	Buncrana	1·86
,,	Llandovery	1·99			

AUGUST, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg	Date	Min. Deg	Date.	No. o Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·76	— 1·98	·14	9	12	88·4	30	44·6	3	0	0
II.		Maidstone (Hunton Court)...	2·46	+ ·22	1·25	9	10	...	...	...	...	..	...
,,		Strathfield Turgiss	·89	— 1·53	·21	10	8	83·7	30	45·4	1	0	0
III.		Hitchin	1·17	— 1·11	·25	1	10	84·0	30*b*	46·0	2	0	...
,,		Banbury	1·64	— 1·06	·50	13	10	81·0	31	42·0	3	0	..
IV.		Bury St. Edmunds (Culford)	1·50	— ·67	·28	10	13	85·0	31	39·0	2	0	..
,,		Norwich (Cossey)	...	...	...	...	...	...	...	...	...	..	...
V.		Weymouth(LangtonHerring)	1·13	...	·46	1	9	75·0	24	49·0	3	0	...
,,		Barnstaple.....	1·17	— 2·93	·43	9	10	78·0	24	48·0	5,18	0	..
,,		Bodmin	3·04	— 1·80	·85	13	17	72·0	26*c*	46·0	3	0	0
VI.		Stroud (Upfield)	1·87	— 1·30	·71	13	9	84·0	30	45·0	2,17	0	...
,,		ChurchStretton(Woolstaston)	1·54	— 2·54	·50	13	13	79·5	30	45·0	3	0	0
,,		Tenbury (Orleton)	1·46	— 2·26	·85	9	11	82·5	30	36·5	3	0	0
VII.		Leicester	1·80	...	1·03	9	13	85·6	30	44·0	3	0	0
,,		Boston	1·86	— ·75	·52	18	12	90·0	31	40·0	3	0	...
,,		Grimsby (Killingholme).....	...	...	...	...	...	...	...	...	...	...	...
,,		Hesley Hall [Tickhill].....	1·70	...	·31	9	14	84·0	30	41·0	5	0	0
VIII.		Manchester (Ardwick).....	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ...	2·59	— ·04	·82	10	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·35	— 2·45	·64	15	16	77·0	30	38·0	4	0	...
X.		North Shields	1·95	— 1·14	·79	18	9	76·5	31	41·5	4	0	0
,,		Borrowdale (Seathwaite).....	8·72	— 2·32	2·20	15	15	73·5	24	40·5	4	0	...
XI.	WALES.	Cardiff (Ely).....	2·06	— 3·27	·53	15	13	...	...	...	...	...	...
,,		Haverfordwest	1·90	— 3·07	·47	13	13	73·0	29	40·0	2	0	...
,,		Plinlimmon (Cwmsymlog) ...	3·06	...	·63	26	15	...	...	...	...	...	...
,,		Llandudno.....	1·35	— 1·84	·39	12	11	71·3	30	44·8	4	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·00	— 2·27	·37	21	15	70·6	23	37·2	3	0	...
,,		Jedburgh (Sunnyside).....	·93	— 2·44	·26	21	16	71·0	30	39·0	3	0	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory)	3·23	— 1·99	.55	30	19	...	...	36·0	2,3	0	...
,,		Oban (Craigvarren)	3·58	...	·75	30	24	67·8	13	43·0	4	0	..
,,		Mull (Quinish).....	3·19	...	·44	30	24	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·60	— 2·48	·50	11	7	...	...	...	...	...	...
,,		Arbroath	1·29	— 2·04	·68	10	7	71·0	29	43·0	3	0	...
XVII.		Braemar	1·37	— 3·06	·96	10	13	68·4	6	34·5	18	0	5
,,		Aberdeen	1·01	...	·17	10	11	75·0	20	38·0	3	0	...
XVIII		Lochbroom	3·45	...	1·21	1	19	...	...	...	...	...	...
,,		Culloden	·88	— 2·12	...	...	...	69·0	30	41·0	22*e*	0	1
XIX.		Dunrobin	..	...	...	...	...	...	...	...	...	...	...
,,		Kirkwall (Swanbister).....	2·31	...	·47	1, 11	20	68·4	20	37·0	4	0	...
XX.	IRELAND.	Cork (Blackrock)	2·77	— 1·06	·63	11	19	78·0	6	46·0	10	0	...
,,		Dromore Castle	3·82	...	·60	14	17	69·0	8	43·0	2	0	...
,,		Waterford (Brook Lodge) ...	3·04	...	·76	12	17	74·0	6	44·0	11	0	0
,,		Killaloe	2·26	...	·35	21	21	72·0	var.	48·0	14	0	...
XXI.		Carlow (Browne's Hill)	2·16	— 1·57	·53	21	20	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·50	— 1·68	·37	21	13	75·6	30	47·0	11	0	0
XXII.		Ballinasloe	2·45	— 1·58	·30	20	21	70·0	5	41·0	1	0	0
XXIII		Waringstown	2·44	— 1·00	·32	12*a*	15	75·0	6*d*	42·0	3	0	...
,,		Londonderry (Creggan Res.).	2·16	...	·38	30	20	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·70	— ·95	·52	6	19	69·0	29	42·0	20	0	...

a And 21. *b* And 31. *c* And 27. *d* And 8, 20, 29. *e* And 23.
+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON AUGUST, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather of the early part of the month was generally unfavourable to agricultural and harvest operations and detrimental to the quality of the grain crops. The sky was overcast and the atmosphere loaded with moisture, and the nights were cold and foggy. The latter part of the month was, on the other hand, magnificent for harvest work.

HITCHIN.—The hottest August in our record.

BANBURY.—A favourable month for agriculturists, with great crops of pears and plums. Mean temp. 61°. TS on 12th, haze on 22nd and 29th.

LANGTON HERRING.—Rainfall 1·45 in. below the average; no R fell during the last 15 days, during which time a good wheat harvest was carried in excellent condition. Mean temp. (63°·1) 0°·6 above the average of 15 years. The prevalence of fogs, which occurred on eight days, is the most noticeable feature of the month. Solar halo on 3rd.

BODMIN.—A very genial month, with glorious weather for the abundant harvest.

WOOLSTASTON.—A favourable harvest month, the latter part being extremely hot. Mean temp. 60°·2. Severe TS on 13th.

ORLETON.—The temperature was low till the 18th, and the sky was generally covered with clouds with the exception of a few days about the 6th, on which day the temperature rose to 81°·2. From the 18th till the end the weather was fine and dry, and the temperature high, the mean of the month being about 0°·3 above the average of 25 years. A heavy, steady fall of R took place on the night of 9th. Pressure was generally high and steady. Distant T on 13th, L on night of 26th, dense fog on 24th and 30th.

LEICESTER.—A seasonable month; dry upon the whole, and very hot at the close.

BOSTON.—Harvest commenced generally in this district on the 24th. The weather towards the end of the month was very hot, the temp. in shade during the day varying from 87° to 90°. Fruit crops generally very abundant, plums especially plentiful, some trees being so laden as to break the branches.

WALES.

HAVERFORDWEST.—On the whole a fine harvest month with no excessive temperature, though 70° and upwards was registered on eleven days. There was very little sunshine. Close, damp, foggy weather prevailed more or less during the last fortnight. The rainfall, however, was less than that of any August during 37 years, except in 1858 and 1880, in which years only 1·63 in. and ·64 in. fell. Corn crops were very fair, oats very good, and there was plenty of grass. Mean temp. 58°·8.

LLANDUDNO.—Nothing peculiarly excceptional occurred during the month as regards temperature, but the rainfall was less than half the average. With the exception of the 5th, which was rather windy and dusty, the first 9 days were bright and very fine, so also were the last 4, besides being the warmest of the month. The mean temp. (59°·7) was 1°·2 below the average, and there were 159 hours of bright sunshine. There were only two days without sun, but the aggregate was considerably less than in the preceding month. As a rule here the mean temp. of July is the highest of all the months, but this year, owing to the deficiency in July. August had the advantage by a small fraction. The total range of temp. (28°·3) was 2° below the average, and the diurnal range (11°·3) was also below the average to about the same extent. The weather on the whole was favourable for all green crops, but owing to the slight deficiency of temperature, the corn crops while fairly abundant in quantity were some-

what later than usual, though mostly cut by the end of the month. The health of the community was good and singularly exempt from the usual summer ailments.

SCOTLAND.

CARGEN.—A dull month generally. The mean temp (57°·2) was 1°·6 below the average, and the duration of sunshine was also small. Very little corn was cut at the close.

JEDBURGH.—The weather was dry and warm, especially during the last half of the month, and vegetation made great progress. The rainfall, although there were almost as many wet days as usual, was 1·69 in. below the average of 22 years. The fruit-bush crop was abundant and good. Corn reaping was fully a month later than usual, no corn being cut in this district until the 28th. T on 10th.

OBAN.—An equable rainfall with somewhat broken weather characterised the month and much improved the green crops, but haymaking was backward and the crop light. The mean temp. was lower than last year, but with a smaller daily range. S.W. and S. winds were almost constant. Fog on 6th and 23rd.

QUINISH.—A cool, unsettled, showery month.

ABERDEEN.—Fine and dry weather prevailed throughout the month, the rainfall being more than two inches below the average.

LOCHBROOM.—The commencement of the month was wet and stormy, but on the 3rd the weather became fine, and it proved a very fine month, indeed one the most delightful and seasonable for years. Grass was plentiful and hay well secured. Corn, though naturally late on account of the nature of the previous season, was filling and ripening at the close much better than had been expected.

CULLODEN.—An exceedingly dry month, no R having fallen from 1st to 10th and from 13th to 30th.

SWANBISTER.—From 1st to 12th cold and disagreeable weather prevailed, but from thence to the close the weather was the finest of the summer.

IRELAND.

BLACKROCK.—Generally damp, and often misty and close, though pressure was very high.

WATERFORD.—A dull, wet month, which interfered with harvest work very much. T on 5th and 10th, dense fog on 27th.

KILLALOE.—The rainfall was moderate in quantity, but falling on 21 days with generally close and sultry air, caused much loss and serious delay in hay harvesting. The grain harvest also is unusually late.

DUBLIN.—Although changeable and at times cool and dull, the weather for the most part was favourable. The leading characteristics of the month were: prevalent W. and S.W. winds, often fresh; clouded skies, and rather low temperature until towards the close, when it became much warmer. There was a complete absence of TSS, although sheet L was seen on the evening of 26th. Solar halo on 3rd, fog on 20th and 23rd, high wind on as many as eleven days. Mean humidity 82, mean amount of cloud 6·2.

EDENFEL.—The weather as a rule was moist and humid, the result being that while the usual August ripening of crops remained almost at a standstill, they increased more in bulk of haulm and straw than during any other month of the summer. With a fine September the largest crops for 20 years will be secured throughout Ireland.

SYMONS'S

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THE AUTUMN CONGRESSES.

Of the various autumnal Congresses, the meetings of the British Association at Birmingham, and of the Sanitary Institute at York, alone demand some notice from us. In both cases the gatherings and discussions seem to have been highly successful generally, though meteorological papers were not so numerous as usual at either; and of these space forbids our giving more than a very brief report.

Among the papers read before the British Association were the following :—

Report of the Committee on the Ben Nevis Meteorological Observatory.
Report of the Committee on the Chepstow Meteorological Observatory.
Report of the Committee on Solar Radiation.
HON. R. ABERCROMBY.—*The Peculiar Sunrise-Shadow of Adam's Peak in Ceylon.*
J. T. MORRISON, M.A.—*On the Distribution of Temperature in Loch Lomond and Loch Katrine during the past Winter and Spring.*
J. T. MORRISON, M.A.—*On the Distribution of Temperature in the Firth of Clyde, in April and June, 1886.*
H. R. MILL, D.Sc.—*On the Temperature of the River Thurso.*
A. F. OSLER, F.R.S. (by Professor Balfour Stewart, F.R.S.).—*On the Forms of Clouds.*
W. E. WILSON (by Howard Grubb, F.R.S.).—*On a New Sunshine Recorder.*

METEOROLOGICAL OBSERVATIONS ON BEN NEVIS.

Report of the Committee appointed for the purpose of co-operating with the Scottish Meteorological Society in making Meteorological Observations on Ben Nevis. Submitted by LORD MCLAREN.

The report stated that all observations, both at the Observatory itself and at the sea-level station at Fort William, had been made with the utmost regularity during the year. For the twelve months ending May, 1886, the mean temperatures and pressures at the Ben Nevis Observatory and Fort William were :— Observatory · summer temperature, 39·3 ; pressure in inches, 25·502 ; autumn temperature, 29·9 ; pressure, ·185 ; winter temperature, 22·5 ; pressure, ·244 ; spring temperature, 26·4 ; pressure, ·276 ; year temperature, 29·5 ; pressure,

25·302. Fort William : summer temperature, 55·2 ; pressure, 30·027 ; autumn temperature, 44·9 ; pressure, 29·736 ; winter temperature, 36·5 ; pressure, ·880 ; spring temperature, 43·4 ; pressure, ·873 ; year temperature, 45·0 ; pressure, 29·879. These twelve months were thus characterised by an unusually low mean temperature, the annual mean at the sea-level station, 45·0, being 2·2 below its normal mean temperature. The maximum temperature at the observatory for the period was 60·0 at three p.m, on July 31, which nearly approaches the maximum of previous years—viz. 60·1 at 2 p.m. on August 9, 1884. The lowest temperature was 8·0 on the evening of December 6, 1885, which is the lowest temperature yet recorded on Ben Nevis. The lowest temperature for the three winters had been respectively 9·9, 11·1, and 8·0. During the twelve months the sunshine recorder registered 752 hours of sunshine, which is about 18 per cent. of the possible sunshine. In the previous year the hours of sunshine only amounted to 464. But the most remarkable features in the climate of Ben Nevis during the year were the frequent occurrence of excessive droughts, comparatively large amount of sunshine, and occasional unusually heavy falls of rain and snow. The most remarkable drought yet recorded at the observatory occurred in March last, commencing at 1 a.m. of the 11th and ending at midnight of the 12th, thus extending over a period of 48 hours. The rainfall for the twelve months amounted to 128·33 inches, the largest monthly fall being 24·33 inches in December, 1885, and the smallest 2·85 inches in February following. The heaviest precipitation on any day was 5·34 inches on December 12, and 4·45 inches on January 1—these being heavier than any previously recorded daily falls. On the two days, December 12 and 13, the precipitation amounted to 8·86 inches. For five-day periods the following heavy falls are recorded :—For the five days ending December 15, 10·25 inches ; October 5, 10·02 inches ; January 3, 9·25 inches ; and September 16, 6·13 inches. On the other hand the year was marked by the large number of days on which either no rain fell, or on which the amount was less than 0·01 inch. The number of these days amounted to 126, being thus in the proportion of two rainy days for each fair day. The largest number of fair days in any month was twenty, in August ; and the least, two, in September. In the previous year there were only seventy-nine days without rain, being thus forty-seven fewer than last year.

THE CHEPSTOW METEOROLOGICAL OBSERVATORY.

Third Report of the Committee appointed for the purpose of co-operating with Mr. E. J. Lowe in his project of establishing on a permanent and scientific basis a Meteorological Observatory near Chepstow. Submitted by PROFESSOR BALFOUR STEWART.

The Committee expressed their sympathy with Mr. Lowe and his friends under the unfortunate circumstances that had tended to retard local action. The Committee saw such evidence of local interest in the undertaking, that they desired to have an early opportunity of co-operating with the local committee. They therefore asked for their re-appointment, and requested that the unexpended sum of £25, and an additional sum of the same amount, be placed at their disposal for the purpose.

THE PECULIAR SUNRISE SHADOW ON ADAM'S PEAK IN CEYLON.

By The Hon. Ralph Abercromby.

In this paper the author dealt with a great peculiarity which has been noticed by many travellers about the shadow of Adam's Peak at sunrise. The shadow, instead of lying flat on the ground, appears to rise up like a veil in front of the spectator, and then suddenly to fall down to its proper level. Various theories have been propounded to account for this, and it has usually been supposed to be due to a sort of mirage. The author, in the course of a meteorological tour round the world, spent a night on the top of the peak, 7,352ft. above the sea, and obtained unmistakeable evidence that the appearance is due to light wreaths of thin morning mist being driven past the western side of the mountain by the prevailing north-east monsoon up a neighbouring gorge. The shadow is caught by the mist at a higher level than the earth, and then falls to its own plane on the ground as the condensed vapour moves on. The appearance is peculiar to Adam's Peak, for the proper combination of a high isolated pyramid, a prevailing wind, and a valley to direct suitable mist at a proper height on the western side of a mountain is only rarely met with. Any idea that the appearance could be caused by mirage is completely disproved by the author's thermometric observations.

ON THE DISTRIBUTION OF TEMPERATURE IN LOCH LOMOND AND LOCH KATRINE DURING THE PAST WINTER AND SPRING.

By J. T. Morrison, M.A.

The author made observations on the temperature of these lakes on or about the term day of each month from December, 1885, to June, 1886, in continuation of Mr. J. Y. Buchanan's researches. These included the whole length of Loch Katrine, and the head and middle part of Loch Lomond, the deepest sounding, 99 fathoms, being got near Inversnaid, in the latter lake. At Inversnaid from December till March the water was each month of uniform temperature from surface to bottom, the temperatures being—December 22, 1885, 42°·8; January 21, 1886, 41°·2; February 23, 1886, 40°·05; March 23, 1886, 39°·05. In the deepest sounding obtained on Loch Katrine, 79 fathoms, a similar distribution was met with up till February, the readings being—December 23, 1885, 42°·3; January 22, 1886, 40°·4; February 24, 1886, 39°·0. And, though the maximum density point was thus attained in February, uniformity still prevailed in March down to a depth of 70 fathoms, the readings on March 24 being—surface 38°·1, 70 fathoms 38°·1, 79 fathoms 38°·7. In April the temperature distribution usually found in spring had set in in both lakes, the surface being warmest, the bottom coldest, and the temperature falling more and more slowly with increase of depth. The circumstance of most interest, however, was that the warmth of the bottom layer increased monthly over the deepest parts of both lakes, as follows:—Loch Lomond (99 fathoms), March 39°·05, April 39°·4, May 40°·3, June 40°·6; Loch Katrine (79 fathoms), March 38°·7, April 39·1°, May 40°·1, June 40°·65. This rise was evidently due not to the conduction of heat nor to the penetration of solar radiation, but to some drainage or oozing causing mixture. This supposition seems necessary also to explain the behaviour of Loch Katrine in March. Drainage *en masse* appeared

to occur chiefly in winter and spring, not in summer when the river water and the lake surface water were much warmer than the deep water of the lake. The mean temperature of Loch Katrine probably had a greater range than that of Loch Lomond. The shallower parts of the lakes resembled the deep parts as to uniformity of temperature up till March, but their yearly range was greater. In both lakes the mean temperature became uniform along the whole length about April 4.

ON THE DISTRIBUTION OF TEMPERATURE IN THE FIRTH OF CLYDE IN APRIL AND JUNE, 1886.

By J. T. Morrison, M.A.

Serial temperature soundings were made by Dr. Mill, Mr. John Murray, and the author throughout the Clyde district during the latter parts of April and June last. It was found that in matter of temperature the waters of the district were divisible into four groups : I. North Channel and the plateau south of Arran ; II. the Arran and Dunoon open basins ; III. the deep sea lochs ; IV. the shallow-sea lochs. The average temperature in each group at every depth was calculated for April and June. In April in all groups there was a deep layer of uniform temperature overlaid by a layer of temperature rising steadily to the surface. In groups II., III., and IV. the uniform deep temperatures are almost the same, about 41°·4 ; in group I. it is 41°·8. In June the superficial layer of varying temperature had thickened to about 20 fathoms. The deep temperatures in the groups were now very different :— Deep temperature in April, 41°·8, 41°·3, 41°·5, 41°·5 ; deep temperature in June, 46°·7, 43°·9, 43°·8, 45°·3, ; rise of temperature, 4°·9, 2°·6, 2°·3, 3°·8. To groups III. and IV. analogues were found in a deep and a shallow basin of Loch Lomond, in both of which the bottom temperature rose between April and June. From this it was inferred that land influences, especially drainage *en masse*, produced most of the effect noticed in III. and IV. The great rise in the North Channel and southern plateau was evidently due to a warm oceanic current. The rise in temperature in group II. was due to the incoming of warm water from without. As the water between 30 and 75 fathoms in this group was very uniform in temperature, and as the south plateau was 25 fathoms below the surface, it was supposed that the dense plateau water was carried into the open basins (group II.), and through convection mixed thoroughly the water below 30 fathoms there. Loch Goil was specially remarkable for its isolation and the small rise of bottom temperature—0°·6 in two months. In Upper Loch Fyne a lenticular mass of water below 43°·0 was found in June to float between two warmer layers. Its greatest thickness, 30 fathoms, was opposite Inverary. The bottom layer of 44°·0 was not found to be in connection with any equally warm layer either inside or outside of the loch.

(*To be continued.*)

THUNDERSTORMS AND HEAVY RAINS OF SEPTEMBER 3RD TO 5TH.

From Falmouth on the south to Glasgow on the north, and from Deal on the east to Swansea on the west, reports have reached us from all parts of the country relating to the series of severe storms which took place on the night of Friday, September the 3rd, throughout the whole of the day and night of Saturday the 4th, and on into the morning of Sunday the 5th.

In all quarters the downpour seems to have been great, and the darkness phenomenal, while the thunder and lightning were exceptionally severe.

Of the very heavy rainfall experienced at Falmouth, details are given by our correspondent, Mr. Fox, on another page. At Portsmouth, from half-past eleven on Saturday night (4th) to two a.m. on Sunday morning (5th), a similar downpour was experienced, thoroughfares being rendered impassable and basements flooded. At the Park Hotel, casks of wine, spirits and beer were floated about. At Deal extraordinary effects, it is said, were witnessed; and of the alarming nature of the catastrophe at Swansea we were able to give an idea last month.

In some cases much mischief was done by the lightning, as, for instance, at Wood Lee, near Egham, where a large hay rick was struck, and damage estimated at £300 was done; at Lavender Hill, near Tunbridge, where a house was struck and greatly damaged, a chimney shaft and an oak tree being also struck; and at Moor Park, near Rickmansworth, the seat of Lord Ebury, where a tree was struck, the bark being completely ripped off, and two heifers which were sheltering beneath it were killed.

At Glasgow streams ran down the steep streets bordering George Street, and dwellings in the eastern districts were flooded to a depth of three feet, torrents of rain falling for fully an hour and a half.

But the full force of the storm, or, indeed, of the whole series of storms seems to have been concentrated over a limited area, chiefly in the West Midland Counties of England and in South Wales. Reports from this district, for which we are indebted to the *Hereford Times*, the *Birmingham Daily Post*, and other local newspapers, as well as to the observers who report to us in regular course, are given below, arranged in the order usually adopted, that of the tables in *British Rainfall*. Where possible we have distinguished between the several storms, and we have merely selected the most noteworthy details from a considerable number of stations at which the storms were, perhaps, equally severe, especially as regards the rainfall and its effects.

HEREFORD.

HEREFORD.—One of the elms in the Cathedral Close was damaged, a portion of the bark being ripped off. A fisherman, named

Richard Wigley, was walking up Victoria Street during the full fury of the storm when, immediately after a very vivid flash, he felt a shock in his hand and then in the upper part of his body. He fell to the ground, and was taken into a neighbouring house, but sustained no serious injury. At Messrs. W. Pulling & Co.'s distillery in East Street, at about a quarter to six o'clock (4th), a clerk named Hedger approached the telephone for the purpose of communicating with the offices in Broad Street. He received a violent electric shock, and was hurled from the instrument. He was stunned for the space of two or three minutes, and one side of his face was slightly scorched. *A working man was struck and rendered unconscious in one of the principal streets.

SHROPSHIRE.

LUDLOW.—A severe thunderstorm raged over this district on Saturday evening (4th) and Sunday morning (5th). On a farm at Tagford four beasts were struck, and on another at Snitton seven animals were killed.

CHURCH STRETTON.—A thunderstorm of almost unprecedented severity raged at intervals from noon until late at night (4th). Several trees in the neighbourhood were struck and shivered.

SHREWSBURY.—About seven p.m. (4th) a storm of appalling violence occurred, lasting about an hour and a half. The streets were covered from kerbing to kerbing by the rain, which fell in torrents, and cellars were flooded. Eight sheep, belonging to Mr. Corns, of Lyth Wood, were killed by the lightning, and crops were much damaged.

WHITCHURCH.—A thunderstorm of exceptional severity (4th), lasting an hour and a half, causing floods, and much damage to crops.

STAFFORD.

WEST SMETHWICK.—The most severe storm experienced for many years (4th). David Cox, an engine fitter in the employ of the Birmingham and Midland Steam Tramway Company, was struck whilst engaged in a shed at the terminus, Oldbury Road. It appears that he was using a spanner, when the electric fluid struck the tool, and passing through his arms and legs paralysed him.

ALBION.—The railway station was damaged.

SEDGLEY.—Three sheep belonging to Mr. Whitehouse, of Sedgley, were killed by lightning in a field at Trysull.

WEST BROMWICH.—A pig was killed by the lightning in Lodge Road, and a man residing in Trinity Street was struck, but not seriously injured.

BRADLEY.—A Mrs. Till was struck and injured.

BILSTON.—The lightning passed down a chimney in a house in

* Possibly another account of the accident in Victoria Street.

Oxford Street, occupied by Mrs. Brazier, and set fire to some clothing in an oak chest.

WALSALL.—The tall spire of the Bath Street Board School was struck, and stripped of the greater part of the covering of slates, the roof of the school itself being much damaged. Two men who were sheltering in the doorway immediately under the turret escaped unhurt.

WOLVERHAMPTON.—A terrific thunderstorm occurred on Saturday evening (4th) and was renewed on Sunday morning (5th). On each occasion the rain came down in torrents, flooding the streets and roads.

BARLASTON.—The Rev. Richard Lockyer, vicar of Barlaston, was walking out with some relatives when a brilliant flash of lightning caused him to recoil and fall senseless to the ground. He never recovered consciousness. Death was attributed to heart disease.

FENTON.—Two boys named Harrison, residing at Fenton, were struck and rendered senseless, the elder being so injured that doubts were entertained as to his recovery.

HANLEY.—The embankment of the Trent and Mersey canal gave way, the water carrying with it to the Trent immense stones and trees.

WORCESTER.

BERROW.—About 5 p.m. (4th) the beautiful tower of the church, which dates from the 14th century, was struck, the upper courses of the stone being rendered loose and unsafe, and cracks and holes being caused in the lower part of the masonry. A cottage some five or six hundred yards from the church was burnt to the ground.

WORCESTER.—Two cows belonging to Mr. H. Thrupp, of Bredicott Farm, were killed.

WARWICK.

BIRMINGHAM.—*Shireland Hall, an unoccupied mansion, was com-

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*G. J. Symons, Esq.

SIR,—Two hours after receipt of your enquiry I took steam tram and went to Shireland Hall. It is situated near the main road to Dudley, three miles from Birmingham, and stands in a very isolated position, Shireland Hall Farm being the nearest inhabited building to it. Eleven years ago it was a school conducted by the Rev.—Munns, a celebrated Nonconformist minister; since then it has been empty. It is a square brick building, quite 80ft. square, three storey, and at some time had sleeping apartments added in the rear. These extra rooms were supported by two iron columns, and it was these being stolen on the night of September 3rd caused the back to entirely fall out (about 4.30 p.m.) on Saturday, September 4th. Building materials have been purloined from there for years, the present owner not being known in the neighbourhood. *It was not injured by lightning or rain.* These particulars are given me by an eye witness of the collapse, who added that the newspaper account caused a great many people to visit the place on Sunday, September 5th.

Yours faithfully, JOHN J. GILBERT.

Birmingham, October 8th, 1886.

pletely demolished, though the walls were of immense thickness, the greater portion of one side of the house being razed to the ground. The lower district of Birmingham was flooded. On Sunday morning (4th) a third thunderstorm occurred, in which one flash of lightning killed four out of a group of five cows sheltering under trees in a field near the residence of Mr. Chamberlain at Highbury.

MONMOUTH.

MONMOUTH.—In the first storm on Saturday morning (4th) drains and gutters overflowed, and roads were flooded, growing and cut corn was much damaged, and a large oak was shattered at the Buckholt. In the second storm, which occurred at about half-past four on Saturday afternoon (4th), "after one dreadful crash, a ball of concentrated electricity approached the town from the west, struck a hole in the roof of a house in Chippenham Gate Street, traversed the iron shooting of two or three houses, descended the down-pipe (which did not reach the ground by about two-and-a-half feet), from which it glanced on to the pavement, breaking a stone two and a half inches thick to atoms. A young man named Edward Jones, son of Mr. Edward Jones, coal merchant, was walking in the direction of the pipe at the time, and was but about a yard or so off the electric fluid when it struck the stone. He nearly fell from the shock, and must have had a very narrow escape of his life. The street was filled with a phosphorescent smell for some time afterwards."

LLANGROVE.—The turret of the parish church was struck by lightning, and very seriously damaged, the larger portion of one side being hurled to the ground, the roof and floor of the belfry were pierced, and the bell was broken into a shapeless mass. After striking the turret, the lightning seems to have crossed the roof of the church, in which a large hole was made by a falling block of stone from the turret, to one of the stove chimney pipes. Its path was marked on the outside by the scattering and breaking up of several hundreds of tiles, and on the inside by the curious splintering of rafters and destruction of plastered roof. On reaching the ground, the electric fluid burst up several paving tiles. It is estimated that damage was done to the extent of some £50.

BLAENAVON.—Several houses in Broad Street and in High Street were flooded to a depth of from six to twelve inches by the rain which fell on Saturday afternoon, and part of the Cwmavon new road near Cold Farm, and the wall supporting it, were displaced by the rush of water from the adjoining heights. A tree in St. Peter's Churchyard was struck by lightning.

GLAMORGAN.

CARDIFF.—The new arcade in the High Street was flooded to a depth of several inches, and much damage was done to some of the shops.

BRIDGEND.—A valuable young mare, the property of Mr. Morgan John, of Old Castle-upon-Alum Farm, near St. Bride's Major, was killed, as was also a cow belonging to Mr. Evan Jenkins of Park Street, in his field at Newcastle. It was reported that a horse was killed at Pencoed. Two ricks, the one belonging to Mr. Jenkin Rees, of Ogmore Farm, and the other to Mr. Morris, Danygraig, Newton Nottage, were destroyed.

CAERPHILLY.—A lad named Hughes was playing with some companions in a bakehouse adjoining the Wernddu cottages, when a flash of lightning passing down the chimney severely injured him.

MERTHYR.—Six sheep, which were huddled together in a hollow on the mountain between Merthyr and Cwmpennar, were killed by lightning.

In the RHYMNEY and MERTHYR VALLEY large tracts of pasture land and crops were inundated and dwelling houses were swamped.

BRECKNOCK.

BRECON.—Part of the Watton was flooded, and many cellars were filled with water.

RADNOR.

LLANDRINDOD WELLS.—About 10.30 a.m. on the 4th, one of the chimneys of the Temperance Hotel was struck, and the electric current passing down into a sitting room, struck Mrs. Davies of Llanbister, on the arm, causing a severe burn.

WHIRLWIND AND WATERSPOUT IN SOUTH WALES.

To the Editor of the Meteorological Magazine.

SIR,—In your issue for September is quoted the following from the *Western Mail* :—"During the progress of the storm of September 4th, a waterspout was observed to travel from the bay in the direction of Kilvey Hill. It burst, and immediately ensued a scene the like of which has probably never been seen in England," &c.

I cannot agree with this explanation, viz., that a waterspout existed and burst on Kilvey Hill.

The Swansea valley is similar to those usually found in Wales, and runs N. and S.; Kilvey Hill being on the S.E. extremity. Morriston is located three miles from Swansea on a slope of hill on the western side.

Now you will notice that the rainfall is given at the Swansea Dock, which is within one mile from Kilvey, as 1·13 in. only; at Penllergare, which is about three miles from here in a W. direction, 1·73 in.; while at Morriston I registered the largest fall, viz., 1·93 in. I gather from Mr. R. Capper (Swansea), that the wind on that day was due E., with a force of 0·5 lbs. per sq. foot, velocity 10 miles per hour; hence I am inclined to think we had quite as much, if not more, fall on this western side than on the eastern side.

It would appear to me that within a comparatively small radius,

say of three miles from Swansea, we had on that afternoon, between three and five o'clock, a very heavy rainfall, and that Kilvey Hill suffered more than other places from the peculiar physical character of the ground, as explained by the writer in the *Western Mail.*

Yours faithfully,

E. RICE MORGAN, F.R.Met.Soc.

Morriston, September 30th, 1886.

To the Editor of the Meteorological Magazine.

SIR,—It may be interesting to your readers to know that a few hours after the above occurred, viz., during the early morning of Sunday, the 5th inst., Falmouth was visited with such a downpour of rain that in all probability it fell from a waterspout. There was, however, no whirlwind, as the wind, which had been South, gradually backed to the S.E. by E., and blew with a velocity of only 12 miles per hour, veering subsequently to the S.

The rainfall was wholly unprecedented and partial, as it extended almost exclusively over the town and a portion of the harbour, whilst the surrounding country escaped without any unusual rain. The Beckley gauge at the Observatory registered one inch in 20 minutes, viz., from 1.40 to 2 a.m. So far as I can judge, it was not in the centre of the fall, and has therefore only given approximately the rain which fell. The only sudden fall of rain approaching the above, since the Beckley gauge was fixed at Falmouth, took place on the 4th of October, 1880, when an inch of water fell between 8.30 and 9.30 p.m. There is proof that in one place the rain fell in sheets of water, as the gravel path had patches of the underlying stones laid bare; the surface gravel and the hard sandy earth beneath it being entirely removed. The effect produced was as though several large buckets of water had been suddenly spilt on the different spots. I refer especially to a garden path at Lamorva, in Woodlane, where there were three of these patches of bare stones about 12 to 15 inches apart, which I measured on the next day, in inches, as follows:—8″ by 11″, 6″ by 8″, and 10″ by 26″.

As may be supposed, the gulleys, conduits, and drains became choked with debris or proved wholly inadequate to carry off the water, and hence it overflowed over the roads, washing them bare, and cutting them up as though large mountain torrents had been let loose. The overflow quickly found its way into cellars, and in many cases into the halls, passages and rooms of houses, causing considerable damage. One end of the Moor, it is said, was submerged for a time, and presented the appearance of a lake. Enormous quantities of stones, gravel and sand were washed down into the lower parts of the town, and a channel was cut near the Custom House Quay, where the water must have run fully two feet deep.—Yours truly,

W. L. FOX, F.R.Met.Soc.

Falmouth, 23rd Sept., 1886.

LAND AND SEA BREEZES.

To the Editor of the Meteorological Magazine.

SIR,—The variations in the direction of the wind, due to the diurnal heating and nocturnal cooling of the land, as compared with the more equable temperature of the sea, are frequently to be observed here, although of course very liable to be masked by the more powerful influences usually in operation. Naturally it is in calm, clear and settled weather that the effect is most distinctly seen, and in such conditions it may sometimes admit of numerical demonstration. A good example occurred in June, 1865, a month which was without rain except for a few days at the beginning and end. In that month observations were taken at 8 a.m. and 6 p.m., and the winds (for this purpose) were classed in two groups, easterly and westerly. An analysis of the 60 observations gave the following result:—

	Morning.	Evening.
Easterly winds	18	9
Westerly winds	12	21

A similar analysis of the observations at 8 a.m. and 6 p.m. in September, 1865, which was an almost rainless month, gave a similar, though less striking result. Thus :—

	Morning.	Evening.
Easterly winds	16½	13½
Westerly winds	13½	16½

The tendency of the wind even in settled weather to veer rather than to back, seems to me scarcely to demand the special explanation which Mr. Backhouse suggests. We know that in these latitudes cyclonic disturbances usually produce this effect, and in the finest weather the influence of a centre of barometric depression passing in the far north may be sufficient to give a bias to the wind, determining the route by which it shall change from an easterly to a westerly point.

GEORGE F. BURDER.

Clifton, Oct. 1st, 1886.

ANOTHER SEVERE STORM.

A severe storm broke over the central part of the Isle of Wight last evening. The lightning was very vivid, and rain fell in torrents.—A terrific thunderstorm burst over Portsmouth last night, and in less than half an hour the sewers were overcharged and the streets so flooded as to be impassable. In nearly every part of the town the water covered the pavement and poured into the shops, while cellars were quickly filled. In some of the hotels the fires in the underground kitchens were extinguished, and considerable damage was done to the contents of the cellars. The lightning was very vivid. The storm broke over Aldershot between 7 and 8. The thunder was very loud, and the heavens were lit up by sheet and forked lightning. The storm continued for nearly an hour.—*Daily News*, Oct. 3, 1886.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1886.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	62·2	24	22·1	7	46·8	34·1	35·7	86	103·3	17·3	1·38	14	6·8
Malta	66·2	15	40·2	12	61·1	49·0	47·5	79	128·9	35·5	·83	6	5·0
Cape of Good Hope	97·7	7	48 8	30	79·9	57·4	57·5	80	...	...	3·33	5	3·5
Mauritius	88·0	13	70·0	4	84·6	74·1	70·0	76	140·4	61·3	3·81	16	5·5
Calcutta	96·3	23	60·1	14	89·4	69·0	67·4	72	153·5	48·7	2·35	8	2·8
Bombay	95·7	14	68·7	10	86·4	73·5	69·0	70	149·4	57·9	·00	0	1·0
Ceylon, Colombo	94·8	14	72·8	22	90·7	75·3	72·1	70	149·2	60·0	3·88	8	2·6
Melbourne	98·1	4	43·3	1	70·5	51·8	50·0	68	147·9	33·9	1·72	11	6·2
Adelaide	99·3	2	48·0	11	80·9	56·7	46·7	46	152·7	39·4	*·01	5	3·1
Wellington	77·0	21	44·0	2	68·5	54·7	52·9	73	150·0	40·0	1·37	10	3·6
Auckland	77·0	5	53·0	2, 3	72·0	58·6	54·1	68	144·0	41·0	1·15	11	6·5
Jamaica, Kingston	88·9	27	66·6	25	86·2	70·3	68·9	75	...	...	·31	...	2·1
Barbados	82·0	19	66·0	31	80·0	71·0	71·5	80	145·0	...	2·01	9	6·0
Toronto	53·9	31	— 7·3	1	35·7	24·1	25·0	80	...	— 9·0	3·0*	14	7·2
New Brunswick, Fredericton	48·8	26	—19·0	10	34·0	14·4	20·4	77	...	...		16	6·3
Manitoba, Winnipeg	41·3	23	—15·1	9	27·1	2·4	13·7	83	...	...		6	4·5
British Columbia, Victoria	60·0	29	26·0	1, 3	50·6	34·9	...	...	...	...	2·94	12	...

* [We think this entry must be erroneous.—ED. *Met. Mag.*]

REMARKS, MARCH, 1886.

MALTA.—Mean temp 54°·2; mean hourly velocity of wind 10·3 miles; velocity averaged 33 miles per hour from 8 a.m. to noon on 7th. The sea temp. was unusually low at the close, with pressure very high. Vegetation suffered severely from cold parching wind on 7th and 8th. A waterspout was seen on 21st; halos and parhelia on 27th. J. SCOLES.

Mauritius.—Rainfall 3·05 in. below, and mean temp. 0°·9 above the average; mean hourly velocity of wind 9·4 miles; extremes 23·9 miles on 15th, and 1·9 mile on 26th; prevailing direction S.E. by E. to E. T and L on four days, L on five, T on one. C. MELDRUM, F.R.S.

COLOMBO.—TSS occurred on five days, and L was seen on three other days. F. H. CLARKE, LT.-COL. R.A.

Melbourne.—Mean temp. of air 2°·5, of dew point 2°·2, and rainfall ·45 in. below their respective averages; mean amount of cloud 0·6, and mean pressure ·055 in. above their averages; mean humidity the same as the average. Prevailing wind S. strong on 6 days, max. hourly velocity 24 miles from 3 to 4 p.m. on 6th. T and L on 6th; dense fog on 16th; heavy dew on four days. R. L. J. ELLERY, F.R.S.

Wellington.—Fine almost throughout. Rainfall very small, 1·45 in. below the average. Prevailing wind N.W., moderate on the whole; Mean temp. 0·5, and pressure ·057 in. below their averages. R. B. GORE.

Auckland.—A warm, dry, month, with unusually small rainfall. T. F. CHEESEMAN.

JAMAICA.—Rainfall a little below the average. MAXWELL HALL.

BARBADOS.—Pressure steady and slightly below the average; mean temp. (74°·9) 1°·4 above the average; rainfall 6 per cent. above the average. Prevailing wind N.E., mean hourly velocity (11 miles) about the average; extremes 17 miles and 5·3 miles, L on two days. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, SEPTEMBER, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·86	XI.	Castle Malgwyn	6·38
,,	Margate, Birchington...	1·01	,,	Rhayader, Nantgwillt..	5·82
,,	Littlehampton	1·66	,,	Carno, Tybrith	4·70
,,	Hailsham	1·87	,,	Corwen, Rhug	3·95
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	7·83
,,	Alton, Ashdell.....	1·89	,,	I. of Man, Douglas	...
III.	Winslow, Addington ...	1·57	XII.	Stoneykirk, Ardwell Ho.	3·10
,,	Oxford, Magdalen Col...	2·27	,,	Melrose, Abbey Gate ...	2·84
,,	Northampton	1·29	XIII.	N. Esk Res. [Penicuick]	4·60
,,	Cambridge, Beech Ho...	·95	XIV.	Ballantrae, Glendrishaig	4·42
,,	Wisbech, Bank House..	·97	,,	Glasgow, Queen's Park.	4·45
IV.	Southend	1·15	XV.	Islay, Gruinart School..	5·57
,,	Harlow, Sheering	1·08	XVI.	St. Andrews, Pilmour Cot	2·43
,,	Rendlesham Hall	1·02	,,	Balquhidder, Stronvar..	10·59
,,	Diss	1·28	,,	Dunkeld, Inver Braan..	4·09
,,	Swaffham	1·57	,,	Dalnaspidal H.R.S. ...	7·18
V.	Salisbury, Alderbury...	2·17	XVII.	Keith H.R.S.	1·87
,,	Warminster	2·29	,,	Forres H.R.S.	2·29
,,	Calne, Compton Bassett	2·66	XVIII.	Strome Ferry H.R.S....	6·15
,,	Ashburton, Holne Vic..	3·17	,,	Tain, Springfield.....	2·14
,,	Holsworthy, Clawton...	2·89	,,	Loch Shiel, Glenaladale	10·22
,,	Hatherleigh, Winsford.	2·19	,,	S. Uist. Ardkenneth ...	4·33
,,	Lynmouth, Glenthorne.	3·58	,,	Invergarry	7·18
,,	Probus, Lamellyn	4·06	XIX.	Lairg H.R.S.	...
,,	Wincanton, Stowell Rec.	3·00	,,	Forsinard H.R.S.	1·71
,,	Taunton, Lydeard Ho...	2·84	,,	Watten H.R.S.	1·47
,,	Wells, Westbury.....	2·41	XX.	Dunmanway, Coolkelure	8·94
VI.	Bristol, Clifton	2·68	,,	Fermoy, Gas Works ...	4·18
,,	Ross	2·66	,,	Tralee, Castlemorris ...	4·28
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	3·74
,,	Cheadle, The Heath Ho.	2·94	,,	Newcastle West	2·71
,,	Worcester, Diglis Lock	3·18	,,	Miltown Malbay.....	4·77
,,	Coventry, Coundon	1·85	XXI.	Gorey, Courtown House	3·97
VII.	Melton, Coston	1·54	,,	Navan, Balrath	2·92
,,	Ketton Hall [Stamford]	1·35	,,	Mullingar, Belvedere ...	3·82
,,	Horncastle, Bucknall ...	1·18	,,	Athlone, Twyford	3·67
,,	Mansfield, St. John's St.	1·30	XXII.	Galway, Queen's Coll...	3·88
VIII.	Macclesfield, The Park.	2·58	,,	Clifden, Kylemore	8·13
,,	Walton-on-the-Hill.....	3·67	,,	Crossmolina, Enniscoe..	6·66
,,	Lancaster, South Road.	7·54	,,	Collooney, Markree Obs.	4·47
,,	Broughton-in-Furness ..	7·74	,,	Carrick-on-Shannon ...	...
IX.	Wakefield, Stanley Vic.	1·27	XXIII.	Rockcorry.....	4·22
,,	Ripon, Mickley	1·55	,,	Warrenpoint	2·72
,,	Scarborough.....	1·26	,,	Newtownards	1·70
,,	East Layton [Darlington]	2·55	,,	Belfast, New Barnsley..	3·65
,,	Middleton, Mickleton ..	2·70	,,	Cushendun	2·27
X.	Haltwhistle, Unthank..	4·57	,,	Bushmills	3·16
,,	Shap, Copy Hill	7·81	,,	Stewartstown	3·19
XI.	Llanfrechfa Grange	3·00	,,	Buncrana	3·94
,,	Llandovery	6·42			

SEPTEMBER, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg	Date	Min. D g.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·73	— ·78	·42	10	11	84·2	1	42·2	17	0	0
II.		Maidstone (Hunton Court)...	1·24	— 1·07	·59	21	7	...	...	...	...	...	...
,,		Strathfield Turgiss	1·76	— ·54	·62	2	9	85·4	1	34·2	19	0	0
III.		Hitchin	1·25	— 1·23	·47	2	8	74·0	1	38·0	17	0	...
,,		Banbury	1·99	— ·82	·49	2	12	75·0	1	38·0	11	0	...
IV.		Bury St. Edmunds (Culford)	1·15	— 1·63	·37	10	9	80·0	1	35·0	22	0	...
,,		Norwich (Cossey)	1·25	— 1·83	·37	10	8	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	1·98	...	·57	3	13	75·0	1	41·0	24	0	...
,,		Barnstaple.....	2·63	— 1·65	·60	30	10	77·0	1	48·0	18	0	...
,,		Bodmin	4·13	— 1·11	·82	30	15	73·0	14	45·0	23	0	0
VI.		Stroud (Upfield)	2·89	— ·36	·63	4	12	78·0	1	42·0	17	0	...
,,		ChurchStretton(Woolstaston)	2·79	— ·68	1·05	9	14	68·5	1	38·0	23	0	3
,,		Tenbury (Orleton)	2·88	— ·47	1·01	4	13	72·6	14	36·2	16	0	0
VII.		Leicester	1·60	...	·41	1	14	78·8	4	41·0	16	0	11
,,		Boston	1·04	— 1·57	·25	27	11	81·0	4	40·0	20*a*	0	0
,,		Grimsby (Killingholme).....	...	...	...	...	...	...	...	...	...	...	...
,,		Hesley Hall [Tickhill].....	1·07	...	·38	9	15	74·0	4	38·0	16	0	0
VIII.		Manchester (Ardwick).....	3·58	— ·19	1·10	10	13	70·0	4, 5	40·0	23	0	...
IX.		Wetherby (Ribston Hall) ...	1·19	— 1·89	·37	10	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·84	+ ·26	·94	27	19	77·0	6	38·0	15	0	...
X.		North Shields	1·82	— ·50	·61	9	16	75·0	14	42·8	23	0	0
,,		Borrowdale (Seathwaite).....	20·70	+ 7·48	3·04	29	16	76·2	5	34·5	16	0	...
XI.	WALES.	Cardiff (Ely).....	3·49	— 1·31	·59	25	13	...	...	...	...	...	...
,,		Haverfordwest	5·83	+ ·78	1·34	9	16	67·0	6	38·0	22	0	1
,,		Plinlimmon (Cwmsymlog) ...	6·10	...	1·86	8	15	...	...	...	...	...	...
,,		Llandudno.....	3·56	— ·19	·95	9	14	68·3	9	43·0	16	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	5·65	+ 1·24	1·26	5	15	76·0	4	32·0	16	1	...
,,		Jedburgh (Sunnyside).....	2·32	— ·27	·34	9	18	69·0	4	30·0	16	2	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	..	...	...
XV.		Lochgilphead (Kilmory).....	6·76	+ 1·00	1·60	29	16	...	...	33·0	15*b*	0	...
,,		Oban (Craigvarren)	6·87	...	·95	29	18	72·2	4	40·3	16	0	...
,,		Mull (Quinish).....	5·90	...	·97	7	17	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·30	+ 1·07	1·00	30	12	...	...	...	...	...	...
,,		Arbroath	2·24	— ·83	·45	5	11	68·0	12	37·0	16*c*	0	...
XVII.		Braemar	3·77	— ·17	·91	13	18	71·0	4	27·7	17	2	10
,,		Aberdeen	1·66	...	·61	13	13	70·0	1	33·0	16	0	...
XVIII		Lochbroom	3·74	...	·63	27	19	...	...	...	...	...	...
,,		Culloden	2·49	— ·41	...	...	...	68·0	3, 4	35·0	16*c*	0	7
XIX.		Dunrobin	2·01	...	·66	13	10	68·0	3	37·0	17	0	...
,,		Kirkwall (Swanbister)..... ..	1·82	...	·29	27	19	61·1	1	39·8	17	0	...
XX.	IRELAND.	Cork (Blackrock)	4·03	— ·12	·94	9	18	68·0	1	44·0	9	0	...
,,		Dromore Castle	4·39	...	1·40	27	17	69·0	2	35·0	22	0	...
,,		Waterford (Brook Lodge) ...	4·44	...	1·10	9	17	66·0	2	38·0	23	0	1
,,		Killaloe	3·39	...	·98	26	19	71·0	1	39·0	23	0	...
XXI.		Carlow (Browne's Hill)	3·93	+ ·67	·90	9	17	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·47	+ ·06	·65	9	15	69·5	13	39·0	23	0	0
XXII.		Ballinasloe	3·34	— ·62	1·07	26	18	64·0	4	33·0	23	0	0
XXIII		Waringstown	3·26	— ·09	·55	11	16	71·0	3	33·0	22	0	4
,,		Londonderry (Creggan Res.).	4·60	...	1·01	7	19	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·76	— ·28	1·06	13	16	67·0	4,5*d*	36·0	22	0	...

a And 23, 24. *b* And 22. *c* And 17. *d* And 6.

+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON SEPTEMBER, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The harvest was secured in brilliantly fine weather and housed in excellent order. The sun had great power in the middle of the day all through the month, but the nights were cold, though without any actual frost. The temperature was 20° colder at the end of the month than at the beginning.

HITCHIN.—Almost the hottest September in our record. The mean temp. of July, August, and September was over 60 degrees, and only five inches of R fell in the four months June to September.

CULFORD.—The continued drought has been severely felt here, and will undoubtedly affect the root crops and late vegetables. T and L on 4th; distant T on 7th.

LANGTON HERRING.—Very favourable weather for ingathering the harvest. Rainfall just one inch below the average; mean temp. slightly above the average. The mean min. temp. was more than a degree above the average, and the max. (75° on 1st) had only once been exceeded in 14 years, 76° having been registered on September 4th, 1880. The persistent N.E. wind from 14th to 24th was noticeable. A very violent TS occurred on the evening of the 3rd. Fog on 12th.

BODMIN.—A very fine month. Mean temp. 58°·8.

WOOLSTASTON.—A perfect harvest month. Mean temp. 54°·9. A terrific TS occurred on the 4th, commencing about 6·40 p.m. and lasting nearly two hours, during which time the L was almost absolutely continuous; comparatively little damage, however, was done.

ORLETON.—Cloudy, damp, and gloomy till the 4th, when great darkness occurred at 10.30 a.m. with R and distant T, followed by a severe TS from 6 p.m. to 7 p.m. with heavy R, passing from S. to N. Much R fell again in the night of the 9th, after which there was no measurable R till the 25th, and the weather was generally warm and pleasant, but without much sun, and the nights were frequently cold. Mean temp. 0°·6 above the average of 25 years; pressure generally high and steady. About the 20th the air was full of aphides, although there had been none on the hops all through the season.

LEICESTER.—A very fine, dry month, quite suitable for the harvest, which was nearly over at the close. No R fell between 12th and 25th.

MANCHESTER.—The first twelve days were unsettled and wet, then the weather cleared, and for the next twelve days it was fine, though rather cold; the concluding six days were again unsettled and wet.

SEATHWAITE.—Several severe storms occurred during the month, and in addition to the fall of 3·04 in. of R on the 29th 1·99 in. fell on the 6th and considerably more than two inches on each of four other days.

WALES.

HAVERFORDWEST.—The first twelve days were very wet and most unfavourable for the harvest which was unfortunately late this year, owing to the absence of high temperature and sunshine. ·28 in. of R fell in 4 min. at 2.40 p.m. on the 8th. From 13th to 24th cold, fine, and often bright weather prevailed, with fresh easterly winds, which dried up everything in a remarkable manner. High night temperatures prevailed all through the month, except from 12th to 24th. The R with high mean temp. of the first twelve days, damaged a great deal of corn, and was more disastrous than the wet September of 1885.

LLANDUDNO.—The weather of the month was somewhat unsettled, and the usual and inevitable equinoctial gales were experienced; one from the S.W. occurred on the 9th and continued for 24 hours; another of like duration from the E. on the 21st. Nevertheless there were some very fine days, and particularly a spell of dry, bright weather occurred from the 13th to the 20th inclusive.

From the 13th to the 24th there was no R. The mean temp. was but slightly (0·7) below the average. The total range of temp. (25°·3) was 4° below the average, and the diurnal range (10°·6) was also below the average by 1°·9, showing a striking equality of temp. for this period of the year. Sunshine, however, was decidedly deficient, particularly during the last week. T on 4th.

SCOTLAND.

CARGEN.—The first twelve days and the last six were very stormy and wet. Mean temp. (53°·5) 1°·3 below the average. Sunshine 40 hours below the average. 1·10 in. of R fell in 20 minutes during a TS on 5th.

JEDBURGH.—The corn-cutting in the lower part of this district was completed and mostly housed in good condition before the close, but in the higher districts there was still much to cut. The crop was decidedly far above what was expected, and over the average. Root crops were good and potato disease was not mentioned. The plum crop was good, but apples and pears were very short. Foliage was changing colour rapidly, and the leaves were falling fast at the close. L on 28th.

OBAN.—After heavy R at the commencement of the month there was excellent harvest weather, but it came too late for the whole crop. Some, however, was well saved and of excellent quality. T on 26th, with heavy gales and R to the close, and high spring tides. Gales occurred also from 6th to 9th.

QUINISH.—Tremendous gales with much R prevailed from 5th to 13th. The rest of the month was fine, and harvest was mostly secured in good order by the close.

ABERDEEN.—The weather throughout the month was fine and dry. Rainfall greatly below the average. Faint aurora on 10th and 26th. Vivid L on 27th.

LOCHBROOM.—The month was a curious mixture of beautiful and of boisterous weather; first fine, then wild, then a period of most beautiful weather, succeeded by a very severe storm, intense cold, several H showers, and S covering the tops of the hills.

CULLODEN.—The month generally was fine; the periods from 8th to 13th and from 15th to 27th were very fine, warm, and sunny. Harvest good and well advanced. There was very heavy R for 12 hours on 14th.

SWANBISTER.—Moderate S.W. winds kept the weather mild during the first half of the month. N. winds set in on 19th, followed by heavier R and low temperature. Strong gales on 9th and 28th damaged the crops. Fog on 6th; L on 27th.

IRELAND.

BLACKROCK.—With the exception of a few bright days, the weather was dull and humid, with misty R. Mean temp. 56°·5.

WATERFORD.—The weather was very broken for harvest work. Rainfall ·72 in. above the average of 25 years. During a TS on 9th a tree near this station was split by L. S.W. gale on 27th.

KILLALOE.—Ten days of very fine weather, from 13th to 23rd, enabled farmers to save and gather much corn and hay, which, up to the 14th, was in peril of being seriously damaged. The month closed with high winds and much R.

DUBLIN.—Two distinct types of weather presented themselves during this month—cyclonic, rainy, and even stormy from the 4th to the 13th, and again after the 24th; but anti-cyclonic, quiet and dry, with easterly winds from the 14th to the 24th inclusive. Temperature ranged about the average. TS on 4th, and distant T on 5th. Lunar rainbow on 11th. L on 26th and 27th. Fog on 5 days. High winds on as many as 12 days. Mean humidity 84; amount of cloud 5·6; prevailing winds S.W., W.S.W., and N.E.

EDENFEL.—The wet, unsettled, equinoctial period, which commenced on the 4th, terminated on the 13th in the heaviest rainfall yet recorded this year (1·06 in.), during which pressure, which was already 29·90 in., continued to rise, whereupon there followed eleven days of fresh, dry, and clear weather, enabling the greater part of an abundant harvest to be not only cut, but carried without a shower, an experience unprecedented here in 25 years.

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THE AUTUMN CONGRESSES.

(*Continued from page* 132.)

THE NORMAL FORMS OF CLOUDS.

BY A. FOLLETT OSLER, F.R.S.

The object of this paper, which was read by Professor Balfour Stewart, was to explain a theory with regard to the principles that may have the greatest effect in producing the leading forms clouds assume. Premising that there were many additional influences that produce or propagate further changes and variations in these forms, but which might be regarded as exceptional or occasional, the author said that the causes with which his paper dealt might be classed under three heads :—1. The diminished specific gravity of the air when more or less charged with invisible vapour. 2. The differential horizontal motion of the atmosphere. 3. The vertical motion in the atmosphere produced by the heat of the sun's rays expanding the lower air. The first of these was universally recognised as the initial cause of the cumulus, the first-born primary cloud. The invisible vapour, however, that had raised the cumulus or crowning head of condensed vapour, would itself become visible should the atmosphere in which it was travelling become reduced in temperature by any of the cooling influences to which it might be exposed in its travels. The lower atmosphere being always charged with more or less vapour, the cumulus could only be formed when there was so much vapour generated as to float above condensation height. Thus far a calm was supposed to prevail. When the atmosphere was in motion its differential horizontal movement produced the first important modification. Owing to the friction of the earth from the irregularities of its surface and the denser state of the lower air, the upper portion of the cloud moved more rapidly than the lower, and the cumulus sheared over into a slanting position and finally assumed the form of the cumulus stratus. A young cloud was thus distinguishable from a long-travelled cloud ; indeed, one that had gone but a short distance was detectable. In this climate a large well-developed cumulus was seldom formed in the cold season, but they were frequent in summer. The majority of the clouds of the first stage seen in this country were born in warmer latitudes. They came as travelling cumuli, and showed more or less the condition of the cumulus stratus. The invisible vapour, however, was subjected to the same changes of form, due to differential motion previous to its becoming visible, but in this climate it soon rose to the same height at which it was condensed. In summer, and

especially in tropical climates, it might travel long distances in its invisible state, so that it had time to become elongated by differential action, and when condensed it at once assumed the form of the true stratus, in which case it was not seen as a cumulus or cumulus stratus at all. Examining the next stratum above they found that a rather rapid change took place to a drier atmosphere, as was proved by Mr. Glaisher's investigations with regard to the dew-point in his balloon ascents. The cirro-cumulus and cirro-stratus were now found. The differential movement of the atmosphere, though diminished, was still an important agent, and produced results that were not possible in the more bulky and dense clouds of the lowest range. Suppose the heat of the sun to have caused the lower atmosphere to expand considerably. The effect would be to lift up and spread the whole of the superincumbent air and lift the then upper stratum of cloud further from the earth. The flat cloud would spread in all directions, and would be rent into fragments or small groups, and thus produce what was called a mackerel sky, just as a similar result was produced, but by the reversed action, in mud that had dried up and shrunk into small patches while the damp earth beneath remained expanded by the moisture it still contained. Should, however, the expansion in the lower atmosphere take place very slowly, it was possible that the stratum of cloud might remain intact as simply an attenuated cloud. Supposing, however, the atmosphere to be in rapid motion, the cloud or group of clouds would be elongated in the direction of the current. This, if accompanied by expansion from below, would rupture the cloud into ribs or bars at right angles to the current. With a continuous current, and without expansion from below, longitudinal bars would be formed in the direction of the current. When, however, the cloud was stationary or moving slowly, larger or smaller filaments that might be prominent were drawn out in what were popularly called "mares' tails."

A NEW SUNSHINE RECORDER.

Mr. W. E. Wilson explained a new sunshine recorder. The instrument consists of two parts, one of which—the indicator—is affected by the sunshine, and the other registers the indications. The indicating apparatus was a differential metallic thermometer, made of a spiral of two metals (zinc and steel) soldered together. Half of the spiral is right-handed, and the other half is left-handed. The complete spiral is fixed at its upper end. At its lower end a lever or pointer is attached. The upper half, or right-handed portion, of the spiral projects through the roof of a ventilated box, and is exposed to the sunshine. The lower or left-handed half is in the shade. Any change in the temperature of the air does not cause the lever or pointer to move, as the upper half of the spiral tends to move it as much in one direction as the lower half tends to move it in the other. When the sun shines on the exposed upper half, the lever moves and completes an electric current, which passes through the recording part of the apparatus. The recorder consists of a drum, driven by a clock. The drum revolves once in twenty-four hours, and is mounted on an axis, with a screw of ten threads to an inch, which turns in a nut. This gives the drum a slight longitudinal motion, as well as its motion of rotation. The clock makes an electric contact once every minute, and the electric circuit is led through an electro-magnet, which causes a pricker to strike the drum when the circuit is complete. The circuit is led through the lever, &c., of the

bi-metallic indicator, and is only closed when the sunshine causes the lever to close it. When the circuit is complete the electro-magnet pricks a dot every minute, which represents a minute of sunshine. The drum is of such a length that it holds the daily record of sunshine for three months. The instrument is also made to give the total time during which the sun shone in the day.

At York, before the Congress of the Sanitary Institute, the following, among other, papers were read :—

PROFESSOR H. ROBINSON, M.Inst., C.E.—*River Pollution.*
CHARLES ROBERTS, F.R.C.S.—*Medical Climatology.*
SURGEON-MAJOR R. PRINGLE, M.D.—*The Collection and Storage of Rain and Drinking Water.*

Of these, the pressure on our space prevents us referring to more than one.

ON MEDICAL CLIMATOLOGY—A SCHEME FOR DEFINING LOCAL CLIMATES BY COMBINED METEOROLOGICAL AND PHENOLOGICAL OBSERVATIONS.

Having dwelt on the distinctions between meteorology and climatology, the author proceeded to state that if we examine the whole range of living things, we shall find that plants are most exposed to, and most distinctly declare, the geological and climatic conditions of a country or district. Being fixed to the soil, they show its character ; and being confined to one place they sum up the whole range of meteorological phenomena to which they are and have been exposed. The tolerance of different species of plants for different amounts of temperature, rainfall, sunshine, atmospheric impurities, &c., constitutes them veritable weather glasses, of different degrees of sensibility, from which we can gather a more distinct idea of the climate of the place in which they survive than from any number or combination of meteorological instruments : hence the advantages of the phenological method of studying climate.

Having shown how the idea, which is by no means new, had been utilized by Linnæus, by Quetelet, by the Committee of the British Association which revised Quetelet's scheme to suit our British flora and climate, by the Committee of the Meteorological Society, and by Dr. Hoffmann of Giessen, the author goes on to speak of observations received by himself from the Rev. T. A. Preston of Marlborough, and of his own elaborate working up of co-ordinate meteorological and phenological observations from these, and shows that it would not be a difficult task to construct short lists of plants, &c., to represent the various meteorological elements separately, and with a prospect of obtaining results which would be of great value to medical climatology.

1. The different elevations of a country are distinguished by different species of plants and trees, but as our country does not possess decided variations of this kind it is unnecessary to give such a list here.

2. A list of plants, even within a single natural order, such as Ranunculacea (the Marsh Marigold to the Traveller's Joy), could be constructed to show the relative dampness or dryness of the soil and atmosphere of two districts, but the rainfall and atmospheric humidity are best dealt with in conjunction with temperature.

3. The lowest range of temperature of a district is of great importance in connection with many diseases, and the selection of suitable winter health resorts, and the simple survival of many sub-tropical plants in temperate regions is a valuable indication of the general climatic conditions.

4. We possess no ready means of testing the relative purity of the air. The ozone tests fail us at the very outskirts of towns and manufacturing districts, and chemical analysis is difficult and not always satisfactory. Here the growth of plants is of great value, as different species possess different degrees of sensibility to atmospheric impurities of both a chemical and mechanical description.

5. Prevailing winds are indicated by the inclination of trees, especially of rapid growing ones like the common poplar, and by the greater freedom from moss and lichens on the weather aspect of exposed trees, especially of the pine family. Round the coast, and especially on the eastern side of England, trees lean inland from the injury done by sea breezes; but inland the south-west aspect of trees suffers most from winds. This is a subject which is deserving of more attention than it has yet received.

6. The presence or absence of sunshine is indicated by the relative prevalence of leaves and flowers. But this question is largely dependent on rainfall, as a large rainfall not only produces an excess of leaves, but, being accompanied by clouds, the sun becomes obscured by them. Sunshine is also related to temperature, and as a low temperature is shown by the postponement of the blossoming of flowers, and especially by the deficient ripening of fruits, the quantity and quality of the sunshine is indicated by ordinary phenological observations.

Schemes illustrating sections 3 and 4 were given, and a "schedule for determining local climates by phenological observation" constructed from the trees and plants included in Dr. Hoffmann's scheme, completed this valuable paper.

REMARKABLE SHOWERS.

To the Editor of the Meteorological Magazine.

SIR,—I am surprised that the letters of Mr. A. H. Jenkin in your issues of August and September have not elicited any correspondence from your readers. A shower of snails *per se* is not by any means impossible, and admits of ready explanation on the supposition that the snails were previously picked up by one of the small whirlwinds which are not uncommon in England. In the present case, however, the difficulty is the excessive number; one can hardly conceive their existence in any spot in sufficient quantity for a whirlwind to carry away the requisite number to deposit "from one to two thousand shells per square yard" over an area of three acres.

I have been looking up the subject of remarkable showers in the works of many of the leading writers on meteorology, and think a few extracts are of sufficient interest to justify reproduction. They are copied verbatim, that the importance which each writer attaches to the subject may be apparent.

Luke Howard, "Climate of London." 1833. Chalky Rain. The morning of the 24th April, 1781, exhibited here (in the

third region of *Mount Ætna*) a most singular phenomenon. Every place exposed to the air was found wet with a *coloured cretaceous grey water*, which after evaporating and filtering away left the ground covered to the depth of two or three lines.

This grey matter was an *oxide*, produced from a metallic base, or sublimate, ejected, along with a prodigious quantity of steam from the bowels of the mountain, and condensed along with that into this singular mixed rain.

PORTENTOUS RAINS OF MILK, BLOOD, &c.—*Pliny* cites some of these in his Natural History. *The Acta et Monumenta* record for the year, in which M. Acilius, and C. Porcius were consuls, a rain of milk and blood (probably of volcanic origin like the one above described, but the earth of two colours), adding as also often at other times. Again, under P. Volumnius and Servius Sulpicius, a rain of *flesh*, which did not putrify, for the fowls (the vultures) never came near it. In *Lucania*, in the year before Crassus was slain by the Parthians, and his numerous body of Lucanians with him, it rained *iron*. The appearance out of which this came was like sponges; and the haruspices predicted only *superna vulnera* (wounds on the upper parts of the body), the weapons coming from above. When L. Paulus and C. Marcellus were consuls it rained *wool*, about a year after which T. Annius Milo was assassinated; and while the indictment upon his murder was trying, it rained burnt bricks, as is related in the *Acta* of that year."

L. F. Kaemtz, "*Meteorology*," 1845.—SHOWERS OF SULPHUR. "Formerly, and even at the present time, flowers of sulphur have been said frequently to fall with rain; after heavy showers quiet waters were found covered with a yellowish dust, and, as it was easily inflamed, it was concluded to be sulphur; every year the newspapers contained notices of it. More accurate researches have proved that this dust is nothing else than the pollen of certain flowers, and of pines in particular, which was swept off by the wind, and precipitated with the rain; Elsholtz had said this as long ago as 1676.

SHOWERS OF BLOOD.—In the chronicles of the middle ages, showers of blood were often alluded to, for red spots were found on the ground and in the waters; and superstition traced in this the effects of divine anger. This phenomenon occurred from time to time. But microscopic researches have proved that these colourings arose from innumerable vegetables or animals that sometimes filled the waters. Frequently, however, a red powder fell with the rain, containing inorganic principles, and coloured with iron or hydrochlorate of cobalt.

Much attention has been directed of late to red snow; De Saussure, Raymond and others, had long ago seen it on the Alps and Pyrenees. In Baffin's Bay Ross found that the snow was sometimes penetrated several decimetres by the colouring sub-

stance; in the Alps it is observed on declivities that are slightly inclined. By the microscope they are seen to be red granules, the nature of which is not perfectly known.*

SHOWERS OF CORN.—After heavy rains bodies have frequently been found on the ground that possessed a distant analogy to grains of corn, and appeared, like the latter, to be composed mostly of farina, but it has long ago been demonstrated that these were not grains of cereals, and that they had not fallen from the sky. MM. Geoppert and Treviranus have lately studied this subject.

In June, 1830, there were found near Greisau, a village of Silesia, after a rainstorm, a certain number of bodies of a vegetable nature on places covered with turf. These corpuscles were exteriorly of a yellowish brown, of a transparent white within, spherical, occasionally cylindrical, being from 4 to 18$^{mm.}$ long, and from 2 to 4 in diameter. They had the taste of farina, but left in the mouth a sharp and burning after-taste. By rapid dessication, the sharp taste disappeared, and the grain had then the flavour of an almond. Accurate researches have shown that these grains were tubercles of the ficaire (*ranunculus ficaria L.*), a plant very common in Silesia.

SHOWERS OF ANIMALS.—Small animals, such as frogs, fish, snails, &c., sometimes appear to fall with rain; at least they are found in great numbers in fields after rain; but they are animals carried by the wind, drifted by the rains, or invited out of their retreats by the moisture. It has lately been maintained that these animals actually fall from the sky, even in calm weather. To all these assertions, I know no other answer than that which one of the most distinguished naturalists of the age made to some one who assured him that he had seen one of these phenomena with his own eyes. It is fortunate, he said, that you have seen it, for now I believe it; had I seen it myself I should not have believed it.

Sir J. F. W. Herschell, Bart., "*Meteorology.*" 1862. "Showers of fish, frogs, flannel (matted confervæ), bread (edible fungus), infusoria, and other unaccountable substances, are among the more palpable evidences on record of the elevating and transporting power of whirlwinds."

Andrew Steinmetz, "*Sunshine and Showers.*" 1867. "In the middle ages, when the 'anger of heaven' was almost the only means of bridling or frightening men, 'showers of blood' were frequently reported. The rain so designated has fallen in modern times, and the microscope has explained the mystery, tracing the red colour to innumerable microscopic vegetable 'cells.' . Red snow is found on the Alps and Pyrenees, and in Baffin's Bay, but the microscope proves the colour to result

* These granules may be considered as vegetables reduced to their most simple expression, namely to a cell filled with liquid. . . .

from red granules, the nature of which identifies it with a plant. Showers of corn have been reported, but scientific investigation has proved the supposed corn seeds to be the tubercles of the *Ranunculus Ficaria*. The 'showers of sulphur' consist of the pollen of certain flowers. . . . . Frogs, fish snails, etc., appear to fall with rain, but the only established fact is that they are found in numbers in fields after rain. If not wafted by the winds they are merely drifted by the rains, or attracted out of their retreat by the moisture. Of showers of soot, or black rain, we have recently heard much, and a volume has been written on the subject, but with Mr. Symons (our indefatigable authority on rainfall), we believe their origin is the chimneys, to which everybody seems inclined to refer them. The same expounder announces the fall of 'pumice-stone shoals' in Great Britain, but again, with Mr. Symons, without denying that rain may bring volcanic dust (instances of which are on record), we expect to hear of the phenomenon not from one parish or even one county only, but from observers in all parts of the kingdom; therefore, for the credit of the nineteenth century, any man asserting such facts should rigorously sift them ere he announces them to the public.

No doubt whirlwinds will carry up everything within their reach and transport them to a distance; but whatever falls in a shower must be of the earth—unless it be 'meteoric dust,' or matter resulting from the destruction of meteors, falling stars, &c.

Luke Howard witnessed 'a continuous shower of fragments of burnt paper, descending from an elevation which the eye could not appreciate'; but it originated from the burning of the Custom House (12th Feb., 1814), distant in a right line about five miles S., wafted by a S.E. breeze."

Alexander Buchan, M.A., Handy Book of Meteorology, 1868. "The *black showers* which occasionally fall in Scotland are in all likelihood the dust or scoriæ from the volcanoes of Iceland transported southwards."

During the present summer showers of this character appear to have been unusually numerous, for we have not only the shower of snails, which called forth this communication, but in the *Standard*, about a fortnight back, appeared an account of a shower of flies at Cupar, Fife, covering some 600 yards; and in a London weekly, dated September 18th, reference was made to reports of a shower of butterflies at Poole and two showers of frogs. I may perhaps be excused for concluding my letter with an appropriate riddle, which is the earliest meteorological recollection of my boyhood. "What's worse than raining cats and dogs? Hailing omnibuses."—Yours faithfully,

H. SOWERBY WALLIS.

25, *Northwood-road, Highgate, Sept. 28th*, 1886.

RECENT GALES.

To the Editor of the Meteorological Magazine.

SIR,—On October 15th, we were visited by a heavy gale, which wrought considerable damage to property.

It may be deserving mention, as a curious coincidence, that three of the most violent gales of recent times occurred on very nearly the same date of the year, namely :—

Sunday, October 14th, 1877.
Saturday, October 14th, 1881.
Friday, October 15th, 1886.

The first of these was the most destructive in its effects as regards this district.—Yours faithfully,

W. F. DENNING, F.R.A.S.

Bristol, Oct. 16th, 1886.

To the Editor of the Meteorological Magazine.

SIR,—We have just had a very great fall of rain with a violent N.E. gale. My gauge registered—from 3 p.m., Nov. 5th, to 9 a.m., Nov. 6th—1·88in., with an additional amount of 1·37in.; total, 3·25in. up to 9 a.m., Nov. 7—a very heavy fall for this part of Northumberland.—Yours truly,

JOHN COPPIN.

Bingfield, Corbridge-on-Tyne, Nov., 1886.

THE RECENT SUMMER AND THE WEATHER CYCLISTS.

To the Editor of the Meteorological Magazine.

SIR,—The *Meteorological Magazine* for June contained a letter from Mr. Brumham, in which he predicted that the late summer would be one of quite exceptional heat, inasmuch as there were no less than nine recurring hot periods, or cycles, which appeared to apply to the present year.

Perhaps the best comment on this prediction is the following extract from a letter which appeared in *Nature*, for August 12, from Mr. Charles Harding, on "The Persistent Low Temperature." After referring to the fact that the weekly weather reports issued by the Meteorological Office are compiled from observations at stations fairly representative of the whole of the British Islands, Mr. Harding proceeds to say, "These returns show that the low temperature is not limited to any special area of the United Kingdom, but is common to every part. From the middle of May to the beginning of August there was only one week, viz., that ending July 5th, in which the temperature was above the average in the western districts of England, Ireland, and the Channel Islands, whilst in the period of seven months from January 4th to August 2nd, the temperature in the north-west and south-west of England, and in the Channel Islands, has only been above the average in three weeks, ending March 29th,

May 10th, and July 5th; and, averaging the results for the whole of the British Islands, these are the only weeks in which the resultant temperature was above the average, and may fairly be considered the only warm periods during the seven months."

It is true that the temperature of the last two weeks of August was considerably above the average, but even so we get only three out of the thirteen weeks of summer in which the temperature was above the average. Nor was the heat in these three weeks of that exceptional kind which Mr. Brumham led us to anticipate, the maximum shade temperature at Greenwich during the summer having been only 87°, whereas in recent years it has frequently exceeded 90°, and on one occasion reached 97°.

I have given a good deal of attention to the predictions of the "Cyclists" for many years past, and have never met with an instance of a so-called weather-cycle which admitted of a crucial test being applied to it, that did not break down under the test, while all the seeming instances of successful prediction could be accounted for as mere coincidences, being balanced by at least an equal number of similar cases in which the prediction was not fulfilled.

GEORGE T. RYVES.

Tean Vicarage, Stoke-on-Trent, Sept. 30, 1886.

EXTRAORDINARY WHIRLWIND.

To the Editor of the Meteorological Magazine.

SIR,—I beg to enclose with my monthly report a cutting from a local paper, describing a storm last month. I made enquiries about the matter and found the statements correct, except that the boiler mentioned existed only in the reporter's imagination. I am, dear sir, yours faithfully,

W. H. KEMPSTER.

Ballinasloe, Nov. 2, 1886.

On Friday, October 23, one of the most extraordinary occurrences ever witnessed in this part of the country took place at Camla, Taughmaconnell, about four miles from Ballinasloe. At about 12 o'clock a man named Murray was making a hay-rick, when he, in his own words, heard "all of a sudden" a terrible noise in the air, and immediately large quantities of dust, boxes, branches of trees, hay, and oats passed by him and over his head. He was so much afraid that he lost all consciousness for a few seconds, and when he recovered he looked towards his brother's house, which was quite convenient, and saw that the end had been swept away and a large portion of the roof. Sticks and branches of trees were floating in the air, and the wildest consternation prevailed amongst the people of the village. Sergeant Lee, R.I.C., whose barrack is close by, proceeded to the place and found that the report circulated of a "fairy blast" was true, and that the hurricane had proceeded in a straight direction with such violence that it swept everything before it, whether hay, or oats, or stone walls, as if they had been leaves of trees. After wrecking Murray's house, the house of a man named Hurley was stripped, and a large rick of hay carried away to all points of the compass, as if it was composed of feathers. The

stone walls around the house were all blown down, and stones 4 cwt. were removed several yards, and one stone fully 5 cwt. was removed a great distance. Two large stacks of oats were blown by the wind in every direction, and two pieces of iron which depended from a rope at each side round the stack were carried high into the air, and were found about a quarter of a mile away. Malachy Graham's house, further on, met even worse treatment. The end wall was carried away, and two large stacks of oats and a rick of hay were taken away, and portions of them found two miles away. The dwelling and out-houses were shattered in a remarkable manner. All the walls around were levelled. In another house adjoining, which was also wrecked, there was a cart in the yard in which there was a large boiler. The cart, which must at least have weighed 5 cwt., was carried high into the air, and came down reversed, the body being entirely broken and the axletree smashed. The boiler was made little bits of. The damage done is considerable, and a great amount of property is destroyed. The storm went in a direct line, and appears to have expended itself on the Suck. The country around is moorland, and the large farmers are well to do. There is a large bog adjoining. What it was—whether hurricane or storm, or the worst description of "fairy blast," as the people affirm, cannot be told, but one thing is certain, the like was never seen before in Camla or Taughmaconnell.

BRILLIANT METEOR.

SIR,—Last Tuesday evening (2nd Nov.), at a few minutes after 8 p.m., I was startled by suddenly seeing a bright light, which turned out to be a meteor of extraordinary brilliance, in the northern sky, which it illuminated in a most beautiful manner with the vividness of a flash of lightning. As will be seen from the enclosed cutting from the *Western Morning News*, this unusually brilliant spectacle was generally observed in the west.

I am, Sir, yours truly,

ALFRED H. JENKIN.

Trewirgie, Redruth, 6th Nov., 1886.

We cannot re-produce the whole of the cutting, but extract the following :—

The Rev. C. H. Crooke, of Sheepstor, writes :—"The time was, as near as I can state it, 8.5 p.m., ; the body of the meteor appeared to be about eight or nine inches in diameter. It continued its course from N.E. to S.W. for about three or four seconds, and suddenly exploded noiselessly, leaving its course marked on the heavens as if by a red mark of fire scratched on them, which remained visible for some minutes. The colour and effect were similar to those of the electric light, and every object around became clearly visible."

A Torrington correspondent says :—"It passed towards the west, leaving a long tail which remained as a curved line of yellowish red for nearly three minutes."

The Rev. S. Rundle writes :—"A meteor of vivid luminosity passed over Godolphin at a quarter-past eight ; its course was from W. to N.E., and, during its passage of two or three seconds, it obscured the light of the moon which was shining brightly.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1886.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	69·6	24	32·2	11*c*	56·9	40·1	39·3	76	108·7	25·8	1·22	15	5·5
Malta	71·7	7	46·0	14	65·7	53·4	53·0	81	134·3	41·8	·83	8	5·0
Cape of Good Hope	89·0	16	45·0	29	77·6	54·9	56·6	85	...	...	·65	4	3·6
Mauritius	84·7	3	66·0	20	82·0	73·2	68·4	76	135·6	54·3	3·12	18	6·7
Calcutta	103·5	14*a*	64·1	6	96·2	75·2	72·6	68	157·9	53·3	·00	0	1·5
Bombay	91·2	5	71·1	4	88·2	76·2	72·2	72	148·7	60·1	·01	1	0·9
Ceylon, Colombo	91·0	5, 8	72·8	25	89·0	75·7	74·3	77	150·0	59·0	7·26	19	6·1
Melbourne	90·2	3	37·6	30	68·4	50·4	48·7	70	140·0	29·2	·95	7	6·2
Adelaide	94·4	2	44·6	14	72·8	53·6	47·0	56	149·9	36·0	1·42	8	4·7
Wellington	69·0	5, 6	42·3	16	62·9	51·9	50·1	76	132·0	39·0	4·96	10	4·2
Auckland	72·5	1	47·0	13	68·2	57·2	54·6	75	136·0	36·0	2·82	11	7·0
Jamaica, Kingston	92·1	26	65·7	16	87·5	70·3	68·7	76	...	...	4·14	...	4·4
Barbados	86·0	22*b*	67·0	3	82·0	73·0	69·0	70	147·0	...	·78	9	6·0
Toronto	74·5	23	20·2	4	53·7	36·1	38·2	74	...	14·5	2·96	12	5·9
New Brunswick, Fredericton	75·8	23	13·7	5	51·4	29·0	29·8	62	...	...	·30	5	3·3
Manitoba, Winnipeg	74·8	18	— 1·8	2	54·3	30·9	36·5	76	...	...	1·73	12	4·6
British Columbia, Victoria	62·0	6	32·0	4	55·1	40·9	...	...	...	...	1·67	10	...

a And 20. *b* And 23. *c* And 12.

REMARKS, APRIL, 1886.

MALTA.—Mean temp. 58°·8; mean hourly velocity of wind 9·5 miles; velocity averaged 30·5 miles per hour from 8 a.m. to 4 p.m. on the 10th. TS on 29th.

J. SCOLES.

Mauritius.—Rainfall 2·12 in., and pressure ·073 in. below average; mean temp. 0°·6 above average; mean hourly velocity of wind 13 miles; extremes 30·1 miles on 16th, and 2·5 miles on 19th; prevailing direction E. by S. T on 11th and 26th; T and L on 13th and 28th. A cyclone passed N., N.W., and W. of the island from 2nd to 9th, and another N.E., E., and S.E. from 14th to 19th; several vessels were dismasted in the latter.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·4, and mean amount of cloud 0·3 above their average; mean temp of dew point 0°·8, mean humidity 3, mean pressure ·018 in., and rainfall 1·28 in. below their respective averages. Prevailing wind S., S.E., and N.; dense fog on 6th; H on 22nd; hoar frost on 30th.

R. L. J. ELLERY, F.R.S.

Wellington.—Early part fine; wind changed on 11th from N.W. to S., with heavy R, 1·70 in. having been recorded on 12th, the max. for the month; then fine till 17th, and from 25th to 28th. Prevailing wind N.W., and frequently strong. T on 30th. A slight shock of earthquake on 19th. Rainfall 1·44 in., mean temp. 0·4, and pressure ·076 in. above their respective averages.

R. B. GORE.

Auckland.—On the whole a fine warm month, with heavy R (1·14 in.) on the 9th. Pressure unusually high throughout; mean temp. about one degree above the average. Rainfall nearly three quarters of an inch below the average.

T. F. CHEESEMAN.

JAMAICA.—The rainfall of the whole island was about twice the average. A smart shock of earthquake was felt at Kingston at 4.48 a.m. on the 18th.

MAXWELL HALL.

BARBADOS.—Pressure unsteady; mean temp. (76°·8) 2°·1 above the average; mean hourly velocity of wind 11·6 miles, 7 per cent. above the average; extremes 15 miles and 5 miles. Rainfall much below the average.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	3·73	XI.	Castle Malgwyn	9·40
,,	Margate, Birchington...	2·34	,,	Rhayader, Nantgwillt..	10·20
,,	Littlehampton	5·16	,,	Carno, Tybrith	7·13
,,	Hailsham	4·27	,,	Corwen, Rhug	5·16
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	6·62
,,	Alton, Ashdell.....	5·06	,,	I. of Man, Douglas	4·61
III.	Winslow, Addington ...	4·44	XII.	Stoneykirk, Ardwell Ho.	3·62
,,	Oxford, Magdalen Col...	3·16	,,	Melrose, Abbey Gate...	5·04
,,	Northampton	3·47	XIII.	N. Esk Res. [Penicuick]	4·50
,,	Cambridge, Beech Ho...	2·31	XIV.	Ballantrae, Glendrishaig	3·64
,,	Wisbech, Bank House..	4·57	,,	Glasgow, Queen's Park.	2·92
IV.	Southend	2·49	XV.	Islay, Gruinart School..	6·10
,,	Harlow, Sheering ...	3·09	XVI.	St. Andrews, Pilmour Cot	2·95
,,	Rendlesham Hall	2·24	,,	Balquhidder, Stronvar..	7·35
,,	Diss	2·52	,,	Dunkeld, Inver Braan..	4·08
,,	Swaffham	4·16	,,	Dalnaspidal H.R.S. ...	5·47
V.	Salisbury, Alderbury...	5·07	XVII.	Keith H.R.S.	2·29
,,	Warminster	4·27	,,	Forres H.R.S.	1·75
,,	Calne, Compton Bassett	5·75	XVIII.	Strome Ferry H.R.S....	5·78
,,	Ashburton, Holne Vic..	10·19	,,	Tain, Springfield.....	1·24
,,	Holsworthy, Clawton...	6·99	,,	Loch Shiel, Glenaladale	6·32
,,	Hatherleigh, Winsford.	5·28	,,	S. Uist. Ardkenneth ...	4·20
,,	Lynmouth, Glenthorne.	10·18	,,	Invergarry	4·50
,,	Probus, Lamellyn	7·18	XIX.	Lairg H.R.S.	...
,,	Wincanton, Stowell Rec.	5·07	,,	Forsinard H.R.S.	2·30
,,	Taunton, Lydeard Ho...	5·70	,,	Watten H.R.S.	1·66
,,	Wells, Westbury.....	4·63	XX.	Dunmanway, Coolkelure	10·64
VI.	Bristol, Clifton	4·94	,,	Fermoy, Gas Works ...	...
,,	Ross	5·18	,,	Tralee, Castlemorris ...	5·24
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	6·97
,,	Cheadle, The Heath Ho.	4·22	,,	Newcastle West	4·92
,,	Worcester, Diglis Lock	3·63	,,	Miltown Malbay.....	3·25
,,	Coventry, Coundon	4·23	XXI.	Gorey, Courtown House	6·59
VII.	Melton, Coston	3·98	,,	Navan, Balrath	5·40
,,	Ketton Hall [Stamford]	3·47	,,	Mullingar, Belvedere...	4·88
,,	Horncastle, Bucknall...	4·42	,,	Athlone, Twyford	5·43
,,	Mansfield, St. John's St.	5·35	XXII.	Galway, Queen's Coll...	3·69
VIII.	Macclesfield, The Park.	5·15	,,	Clifden, Kylemore	7·03
,,	Walton-on-the-Hill.....	4·41	,,	Crossmolina, Enniscoe..	5·66
,,	Lancaster, South Road.	5·96	,,	Collooney, Markree Obs.	5·44
,,	Broughton-in-Furness ..	6·34	,,	Carrick-on-Shannon ...	4·96
IX.	Wakefield, Stanley Vic.	3·28	XXIII.	Rockcorry.....	4·68
,,	Ripon, Mickley	5·27	,,	Warrenpoint	6·34
,,	Scarborough.....	2·47	,,	Newtownards	4·45
,,	East Layton [Darlington]	5·72	,,	Belfast, New Barnsley..	5·39
,,	Middleton, Mickleton..	5·66	,,	Cushendun	2·84
X.	Haltwhistle, Unthank..	4·61	,,	Bushmills	3·34
,,	Shap, Copy Hill	7·04	,,	Stewartstown	4·87
XI.	Llanfrechfa Grange	5·62	,,	Buncrana	4·68
,,	Llandovery	8·09			

OCTOBER, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shadc.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·43	— ·27	·47	12	23	78·8	4	39·6	14	0	0
II.		Maidstone (Hunton Court)...	2·38	— ·08	·45	12	20	...	...	...	...	...	...
,,		Strathfield Turgiss	3·80	+ 1·06	·52	1	20	75·2	4	33·4	18	0	2
III.		Hitchin	3·65	+ 1·47	·48	12*a*	23	76·0	4	39·0	21	0	...
,,		Banbury	4·19	+ 1·43	·67	12	22	73·0	4, 5	34·0	22	0	...
IV.		Bury St. Edmunds (Culford)	2·76	+ ·59	·45	5	20	75·0	1, 4	35·0	22	0	...
,,		Norwich (Cossey)	2·45	+ ·12	·61	1	15	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	3·93	...	·48	6	24	68·0	5	39·0	18	0	...
,,		Barnstaple.....	7·27	+ 1·82	1·13	1	20	72·0	5	46·0	18	0	...
,,		Bodmin	8·49	+ 2·22	1·01	15	25	64·0	7	39·0	22	0	0
VI.		Stroud (Upfield)	4·44	+ 1·43	·52	12	20	74·0	5	41·0	13*d*	0	...
,,		ChurchStretton(Woolstaston)	4·79	+ ·19	1·30	1	21	71·0	5	41·0	11*e*	0	0
,,		Tenbury (Orleton)	3·47	+ ·23	·48	28	24	75·3	5	35·3	22	0	0
VII.		Leicester	4·23	...	·55	12	20	77·5	5	38·4	14	0	...
,,		Boston	2·98	+ ·95	·55	6	16	82·0	5	40·0	11*f*	0	...
,,		Hesley Hall [Tickhill].....	3·78	...	·61	6	19	71·0	4, 5	32·0	23	1	...
,,		Manchester (Ardwick).....	5·86	+ 1·43	·90	6	19	69·0	5, 12	40·0	11*c*	0	...
VIII.		Wetherby (Ribston Hall) ...	3·67	+ ·31	·75	4	14	...	...	...	...	0	...
IX.		Skipton (Arncliffe)	8·27	+ 1·01	·92	1	22	63·0	30	36·0	21	...	...
,,		Hull (Beverley Road)	3·29	+ ·69	·48	17	23	68 0	1, 4	36·0	23	0	2
X.		North Shields	3·21	+ ·70	1·01	1	21	62·0	3	37·5	23	0	0
,,		Borrowdale (Seathwaite).....	11·27	— 5·28	1·55	12	18	65·0	4	33·0	26	0	...
XI.	WALES.	Cardiff (Ely).....	6·76	+ 1·53	1·00	14	23	...	...	...	...	...	...
,,		Haverfordwest	8·42	+ 1·97	1·72	15	22	68·0	4	38·0	20*g*	0	...
,,		Plinlimmon (Cwmsymlog) ...	11·68	...	3·83	15	18	...	...	...	...	...	...
,,		Llandudno.....	5·77	+ 1·18	1·45	20	18	72·0	5	42·5	22	0	0
XII.	SCOTLAND.	Cargen [Dumfries]	4·77	— ·94	1·29	12	17	69·4	5	34·0	22	0	...
,,		Jedburgh (Sunnyside).....	4·65	+ 1·98	·80	12	22	65·0	5	36·0	22*h*	0	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	..	...	...
XV.		Lochgilphead (Kilmory).....	5·32	— 3·00	1·43	11	17	...	...	33·0	23	0	...
,,		Oban (Craigvarren)	4·19	...	1·13	11	16	68·8	5	32·2	26	0	...
,,		Mull (Quinish).....	3·95	...	·91	11	20	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·00	— ·31	·90	16	13	...	...	...	...	...	...
,,		Arbroath	3·28	+ ·41	·36	15	17	61·0	3	35·0	23	0	...
XVII.		Braemar	4·44	— ·04	1·40	15	23	64·2	1	25·7	23	2	10
,,		Aberdeen	2·48	...	·41	21	21	62·0	2	34·0	14	0	...
XVIII		Lochbroom	3·44	...	1·07	11	14	...	...	...	...	...	...
,,		Culloden	1·74	— ·55	...	...	...	66·0	5	30·0	26	2	12
XIX.		Dunrobin	1·90	...	42	3	11	60·5	7	33·0	26	0	...
,,		Kirkwall (Swanbister)..... ..	...	...	...	...	...	...	...	...	...	...	...
XX.	IRELAND.	Cork (Blackrock).....	5·96	+ 1·22	1·11	14	20	70·0	7	33·0	21	0	...
,,		Dromore Castle	7·77	...	1·78	14	19	66·0	4	34·0	26	0	...
,,		Waterford (Brook Lodge) ...	5·70	...	·93	11	19	65·0	7	31·0	22	1	6
,,		Killaloe	5·22	...	1·13	15	17	67·0	5*b*	33·0	27	0	...
XXI.		Carlow (Browne's Hill)	5·64	+ 1·53	1·01	15	22	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	6·16	+ 2·74	1·56	15	24	64·6	5	36·2	22	0	2
XXII.		Ballinasloe	4·64	+ ·21	1·18	15	17	62·0	4,5	31·0	22	1	0
XXIII		Waringstown	4·61	+ 1·00	·93	15	20	65·0	5	30·0	21	1	6
,,		Londonderry (Creggan Res.).	4·10	...	1·66	15	19	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·82	— ·50	1·07	15	18	66·0	5	32·0	21*i*	2	...

a And 15. *b* And 6, 7, 8. *c* And 14, 22. *d* And 20, 22. *e* And 23, 28. *f* And 14. *g* And 21. *h* And 23. *i* And 25.

+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON OCTOBER, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A mild, showery month, with rainfall considerably above the average. Field flowers were in bloom in great abundance, and trees were still very thickly covered with leaves. TSS on 19th and 20th, which were very severe in the neighbourhood of Aldershot, 14 miles E. of this station, with almost tropical R while it lasted.

HITCHEN.—The hottest October on record; max. temp. on 1st 74°, and on 31st 60°.

BANBURY.—Mean temp. 52°; T and L on 20th; L on 1st and 19th; high wind on 14th and 25th; very slight S on 9th; fog on 6 days.

CULFORD.—Rains with high winds were prevalent, and storms of H occurred very near though not at this station. T and L on 1st and 20th; fog on 18th and 19th.

LANGTON HERRING.—Rainfall ·32 in. above the average of 11 years. The temperature of the month was quite abnormal, and far in excess of that of any other October for 14 years. Mean temp. at 9 a.m., 4°·3 above the average. The max. temp. did not rise above 68°, but the min. only once fell below 42°. A few trees were uprooted during the gale of 15th and 16th. Thick fog on 31st, TS on 4th.

BODMIN.—Very heavy gales from W.S.W. and N.W. occurred on 15th and 16th, of the longest duration recorded here.

STROUD.—A wet but warm month. On the 15th and 16th, severe gales from S.W. and W. occurred, during which a large lombard poplar was blown down. T and L on 10th, 19th, and 22nd.

WOOLSTASTON.—The early part of the month was very warm, especially the 4th and 5th, when the temperature was exceptionally high. A terrific gale set in on the evening of the 15th, and raged all night, pressure having fallen steadily all day. Mean temp. 50°·4.

ORLETON.—The first half of the month was very warm, especially the first week, the temperature rising on the 4th to 74°, and on the 5th to 75°·3, the highest recorded in October since 1859, when on the 3rd it rose to 75°, and on the 4th to 77°. The mean of the month was about 2°·6 above the average of 25 years. After the first week the sky was generally cloudy. Very low pressure on the 16th was preceded by great wind on the 15th, and followed by heavy R (·44 in.) on the 17th. A great darkness passed over from N. to S. about 1.30 p.m. on the 19th, and L was seen after dark on the 20th. Fog was frequent.

HULL.—The middle of the month was very wet; the close was fine and dry, but cold. On the 3rd ·30 in. of R fell in 15 minutes, at 9 a.m.; T and L on 7th; pressure very low on 15th.

NORTH SHIELDS.—TSS on 1st and 21st; fog on 11 days.

WALES.

HAVERFORDWEST.—The month was remarkable for its heavy rainfall, for its stormy character from 9th to 17th, and for its mildness, there being a total absence of frost. The mean temp. (51°·6) is the highest recorded here for October. On the 15th (pressure at 3 p.m. 28, 20·8 in. cor.) occurred a storm of wind, the violence of which has seldom been exceeded in this locality. Many large trees were uprooted, and much damage was done to shipping around the coast. Tremendous floods occurred on the 15th, the highest seen for upwards of 40 years at the Canaston Bridge on the Eastern Cleddan river. Much corn was still in the fields at the close.

LLANDUDNO.—The leading features of the weather in October were a high temp., strong winds and a heavy rainfall. The mean temp. (53°·2) was 1°·8 above the average; the total range (29°·5) was nearly half a degree below the

average, while the mean daily range (8°·9) was nearly a degree and a half below the average. The temperature of the month as a whole was, therefore, not only high, but equable. There were several continuous wet days, in addition to the max. fall of 1·45 in. on the night of the 20th, notably the 1st, when ·93 in. fell, and the 12th, when ·62 in. fell. A thick sea fog set in late on the afternoon of the 8th, after a singularly bright and fine morning, and was so dense that the *Alexandra* steamer, due here from Beaumaris about 5 p.m., failed to reach the pier till midnight, when the fog cleared off. High winds were more than usually prevalent, particularly on the 16th, 17th and 18th, when there was a continuous heavy gale from the N. ; the force of this storm was, however, not felt nearly so much here as along the S. and S.W. coasts of England and Ireland. Owing to the exceptionally heavy rainfall, the air was more humid than usual, and sunshine less abundant, only 68 hours being recorded during the month.

SCOTLAND.

CARGEN.—For the first nine days the temperature was unusually high, and the mean of the month was 2° above the average. The weather was damp and gloomy throughout, only 82 hours of sunshine being recorded, which is 40 hours less than the average. T on 4th ; L on 6th, 18th, 19th. and 30th ; gale on 12th.

JEDBURGH.—The month was marked by the great and continuous fall of R, which retarded the ingathering of the corn very much. In the higher districts of Roxburghshire, a great deal was still uncut at the close. The turnip and potato crops were generally excellent. The rainfall was the largest in October for 22 years, and 2·19 in. above the average of that period, the next wettest October being in 1872, when 4·36 in. fell. TS on 6th.

QUINISH.—The last half of the month was very fine and sunny, with occasional hoar frost.

OBAN.—A very fair month, and warm for the time of year, with a moderate rainfall. All crops were well saved. On the 15th, during the heavy cyclone, the sky was covered all day with small nimbi of fantastic shapes, moving rapidly from N.E. to S.W., with strong gusts from N.E., but no R ; pressure fell considerable, and the air was oppressive and lurid grey in appearance. This station was on the skirts of the depression. T and L on 6th ; H on 10th ; aurora on 18th.

BRAEMAR.—An exceedingly dark, damp, dismal month, only 28 hours of sunshine having been recorded, with 19 days on which the sun was entirely obscured. Crops suffered much in consequence, and were still partly uncut at the close.

ABERDEEN.—While the rainfall was about half an inch below the average, the weather was damp and unseasonable throughout the greater part of the month.

LOCHBROOM.—The finest month of the season, the latter half being beautiful and enabling farmers to secure their crops in a perfect state. Brilliant displays of aurora occurred on the 27th and 28th, followed, as usual, by a sudden change, but not so violent as is frequently the case. Gale on 9th.

CULLODEN.—The first half of the month was generally favourable for harvest work, but from the 18th to the close the weather was calm, moist, and dull. Crops on the whole were well got in ; potatoes good and free from blight, turnips fair. A heavy flood occurred on 18th.

IRELAND.

BLACKROCK.—The weather was very changeable, with great fluctuations of pressure. Mean temp. 51°·3. T on 10th.

DROMORE.—In the middle of the month a severe storm occurred, lasting for three days, 14th to 16th inclusive.

WATERFORD.—Rainfall 1·47 in. above the average. Fog on 6th, 7th, and 8th ; T and L on 10th and 17th ; S.W. gale on 14th ; W. to N.W. gale on 15th ; N.E gale on 16th.

KILLALOE.—Heavy floods occurred in the middle of the month, followed by very fine autumn weather and a light touch of frost.

DUBLIN.—A genial month as regards temperature, but R fell heavily and well-nigh incessantly during the first three weeks, 5·58 in. being recorded on 18 out of the first 19 days. On the 23rd pressure rose decidedly, and drying winds from E.N.E. of considerable strength set in and continued to blow for several days. Some bright sunshine was enjoyed at the close, the 31st being an exceptionally fine, clear day. The rainfall was more than double the average of 20 years. In 1880, in October, the rainfall was very large, 7·36 in. on, however, only 15 days, 2·74 being measured on the 27th alone in that year; and in 1875 7·05 in. fell on 26 days. On the other hand, in 1884 only ·83 in. fell on 14 days. In 1868 also—the "warm year"—the October rainfall was only ·86 in. on 15 days. Fog on 6th and 8th; H on 10th; high winds on as many as 13 days; gales on 4 days. Prevailing winds S.W., E., and N.E.; mean humidity 88; mean amount of cloud 6·0.

BALLINASLOE.—Heavy floods and high winds prevailed from 14th to 18th; many trees were blown down, and a temporary bridge over the River Suck was partially swept away. This was the heaviest flood since November, 1881. H on 10th.

WARINGSTOWN.—The rainfall of the early part of the month imperilled one of the finest harvests remembered. The third week, however, cleared the fields, and little damage was reported.

EDENFEL.—The temperature of the month was throughout much above the average, with but two nights of slight frost. As a result even the ash and the oak still retained their leaves at the close. On the night of the 14th a sudden and considerable fall of pressure took place, accompanied by high drifting wind and remarkably heavy continuous R up to the morning of the 16th, occasioning floods higher than any previously recorded here. From the 17th to the end of the month was generally fine and bright.

LAND AND SEA BREEZES.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Burder's letter in your last number, inasmuch as it reports the wind only twice in the day, does not assist in showing the direction in which the sea and land breezes change at Clifton; so that his examples fail to throw any light upon this question; they only show that, even as far from the sea as Clifton is, it is sufficiently near for the sea and land breezes to overcome the tendency of the wind to blow towards the sun, if such a tendency exists as I have suggested.

I do not understand his explanation of the veering of the wind. A cyclone lying to the north of an observer and moving eastward, undoubtedly causes the wind to veer, but only from a southerly to a northerly direction. This, therefore, cannot account for the veering that takes place as the wind changes from a westerly to an easterly direction, or the reverse. A cyclonic centre lying to the west of the observer in the evening, and to the east in the morning, at the times when the land and sea breezes change, would indeed produce the required effect; but I am not aware that cyclones are apt to be central in any particular place at any given hour of the day.—Yours truly,

T. W. BACKHOUSE.

Sunderland, Oct. 25th, 1886.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCLI.] DECEMBER, 1886. [PRICE FOURPENCE, *or 5s. per ann. post free.*

BAROMETRIC DEPRESSION OF DECEMBER 8TH-9TH.

The greatest barometric depression of modern times naturally claims notice in these pages. According to the Daily Weather Reports the centre passed from the N. of Ireland, across Lanark and over the Firth of Forth out to the North Sea. Therefore, obviously, the lowest readings will come from our friends in the north of England and of Ireland, and from central Scotland.

In the present article I purpose combining two separate aspects of the phenomenon—

I.—*The recent depression in London as compared with previous ones.*

My own observations have now been continuous since 1858, and happily I have been able to watch carefully every important depression. The instances in which the pressure at sea-level has fallen below 28·7 inches are as follows :—

1859	Dec. 26	6.0 a.m.	28·629	*1876	Dec. 4	11.0 a.m.	28·364
1866	Feb. 11	4.30 p.m.	·606	1877	Nov. 12	0.10 a.m.	·693
*1872	Jan. 24	4.47 a.m.	·332	1880	Nov. 16	2.30 p.m.	·695
*1873	Jan. 20	1.0 a.m.	·447	*1884	Jan. 26	7.30 p.m.	·529
*1876	Mar. 12	0.30 p.m.	·447	*1886	Dec. 9	4.45 a.m.	·295

Of these, the six instances marked with a (*) are below 28·6, and therefore may be regarded as the most important. The annexed diagram not only shows these depressions as respects the lowness of the points reached, but also as regards the time of their occurrence, the duration of the low pressure, and the details of each. Nothing could render more evident the important nature of the recent depression. Like Aaron's rod, it swallows up all the others.

If now we seek for records before my observations began, we find in a very useful table of low sea level pressures at Greenwich from 1811 to 1884 given by Mr. Marriott in the *Quar. Jour. R. Met. Soc.*, vol. x.—p. 121, only three instances of lower pressures in London or its immediate vicinity, viz. :—

1814	.....	Jan. 29	.....	5 p.m.	.....	28·233
1821	.....	Dec. 25	.....	5 a.m.	.....	28·016
1843	.....	Jan. 13	.....	0·53p.m.	.....	28·266

These values show how rare is such a pressure as 28·295 in the vicinity of London. I am inclined to think that the values in Table II. are nearly all equally exceptional for their respective localities, for even in Scotland, where the barometric range is much greater than in England, there are very few cases of sea level pressures of less than 28 inches. But there was one altogether exceptional case on Jan. 26th, 1884, when, as stated by Mr. Buchan, "the sea level pressure at Ochtertyre, Perthshire, at 9·45 p.m., fell to 27·333 inches, being absolutely the lowest hitherto observed by man anywhere on the land surfaces of the globe.

II.—*The depression in various parts of the United Kingdom.*

It is impossible, in these pages to print one-tenth of the communications upon this subject, with which I have been favoured. I have inserted in Table I. a few of the records which I believe to be all from verified instruments, and with all corrections applied, and which, either from their lowness, their continuity, or their geographical position seemed of most importance. The lowest pressure at any exact hour is shown by heavy type, and italic type is used for a few readings not made precisely at the hour but computed by interpolation. The stations are arranged according to the absolute minimum, *i.e.*, the lowest pressure occurred at the station first named.

TABLE I.—*Sea Level Pressure for each hour, December 8th-9th*, 1886.

	Belfast.	Newton Reigny.	Leith.	Meltham.	Hull.	Neston.	Hillington	Beckford.	Camden Square.
	in.	in.	in	in.	in.	in.	in.	in.	in.
9 a.m...	*27·89*	28·166	28·081	28·297	...	28·317	28·525	28·48	28·628
10 a.m...	·83	·130	·060	·270	28·30	·298	*·444*	...	·596
11 a.m...	*·72*	·080	28·011	*·237*	...	·263	*·410*	...	·562
Noon ...	·59	28·011	27·959	*·208*	28·30	·191	*·390*	...	·530
1 p.m...	·44	27·975	·909	·155	...	·125	*·362*	...	·486
2 ...	**·39**	·860	·855	·090	28·20	*28·048*	*·335*	...	·470
3 ...	...	·756	·796	28·005	...	27·960	*·287*	28·311	·450
4 ...	...	·687	·729	27·959	28·10	·913	·259	·283	·424
5 ...	...	·625	·707	·914	...	*·864*	·237	·243	·400
6 ...	...	·597	·675	·859	28·00	·832	·201	·203	·384
7 ...	...	·578	·660	·825	...	**·829**	·143	·181	·353
8 ...	...	**·566**	**·656**	**·794**	27·89	*·877*	·103	**·157**	·333
9 ...	...	·581	·671	**·794**	...	·902	·084	·159	·323
10 ...	...	·663	27·707	·837	27·85	·944	**·062**	·163	**·313**
11 ...	...	·706	...	27·884	**27·818**	27·971	**·062**	28·183	·314
Mid. ...	...	·764	...	...	27·90	28·000	28·082	...	*·320*
1 a.m...	...	·824	...	...	...	·021	...	...	·319
2 ...	...	·870	...	...	27·95	28·059	...	...	·320
3 ...	...	·921	...	...	...	...	...	...	·316
4 ...	...	27·975	...	...	27·97	...	...	...	·313
5 ...	...	28·028	...	...	...	...	...	..	·302
6 ...	...	·069	...	...	28·05	...	...	28·280	**·298**
7 ...	...	·124	...	...	...	...	...	...	·314
8 ...	...	·166	...	...	...	28·357	28·215	28·370	·350
9 a.m...	...	28·242	...	28·230	28·30	...	28·261	...	28·416

TABLE II.—*Absolute Minimum Sea Level Pressures.*

Belfast	F. M. Moore, Esq.	8th	1·30 p.m.	27·38
Aghalee, Lurgan	Lancelot Turtle, Esq.	8th	0·30 p.m.	27·436
Cronkbourne, I. of Man	A. W. Moore, Esq.	8th	3·30 p m.	27·555
Newton Reigny, Penrith	T. G. Benn, Esq.	8th	8 p.m.	27·566
Whitehaven	T. Gordon, Esq.	8th	5·25 p.m.	27·567
Leith	Messrs. Bolam & Redpath	8th	7·30 p.m.	27·651
Heaton, Bolton	J. Watkins, Esq.	8th	8 p.m.	27·74
Meltham, Yorks	C. L. Brook, Esq.	8th	8–9 p.m.	27·794
Larden Hall, Much Wenlock	Miss F. H. Rouse-Boughton	8th	8 p.m.	27·99
Hull	Harold Smith, Esq.	8th	11 p.m.	27·818
Thelwall, Warrington	T. G. Rylands, Esq.	8th	6·45 p.m.	27·820
Neston, Cheshire	Reginald Bushell, Esq.	8th	6·28 p.m.	27·821
Hillington, Norfolk	Rev. H. Ffolkes	9th	10–11 p.m.	28·062
Beckford	F. Slade, Esq.	8th	8–8½ p.m.	28·157
Haverfordwest	E. P. Phillips, Esq.	8th	5·30 p.m.	28·209
Berkhampstead	E. Mawley, Esq.	8th	6 a.m.	28·275
Camden Square	G. J. Symons, Esq.	8th	10 p.m.	28·313
		9th	4.45 a.m.	28·295

The velocity of the wind around a barometric depression is proportional not to the lowness of the pressure, but to the gradient (the steepness of its sides) *i.e.*, to the difference of pressure between places comparatively near. This is the reason for that which has puzzled many persons, viz., the not exceptional force of the gale on the 8th. Of course we all know that there was a very heavy gale, but it was certainly not the strongest for 40 years, not strong proportionately to the depression which made such fun of many "domestic" barometers, the wheel ones going round the wrong way till they read "Set Fair 31·0" and in some of the upright ones the mercury disappeared entirely, while in the majority the verniers became useless except where (as was done by some ingenious persons) they were used from the wrong end.

It will be noticed that there was a double minimum in London, which extended across the S. of England. I append a few extracts from letters. A later one will be found on page 172.—G. J. SYMONS.

At 11.40 on the night of the 7th, the mercury stood at 29·304. By 11.45 a.m. it had fallen to 28·207, showing a fall of 1·097 in. in 12 hours.

The wind did not amount to more than a fresh breeze until noon, when it strengthened, and in the afternoon there was a gale, with frequent squalls and rain. The direction was the same throughout the day, about W.S.W.

The minimum pressure (27·821 in.) was recorded during a heavy squall at 6.28 p.m., after which time the mercury rose very slowly.

At 1·58 a.m. on the following morning (December 9th) there was a remarkably vivid flash of lightning, followed immediately by thunder.

The Barometrical readings were taken from a large verified Standard Barometer, by Hicks, of Hatton Garden; they are all corrected, and reduced to 32° Fahr. at mean sea-level. Barometer cistern, 144 ft. above mean sea level.

REGINALD BUSHELL.

Hinderton Lodge, Neston, Cheshire, December 9th, 1886.

Tuesday, the 7th Dec., the weather was fine at times, but at 6 p.m. a heavy squall of hail and wind occurred, the sky clearing for a short time. As night advanced the, weather became worse and heavy rain fell. Barometer, 9 p.m., 29·444. Rainfall, 9 a.m. December 8th, ·83 in.; blowing very fresh, at times very squally, with hail. The weather became worse and more serious every hour; a terrible squall of hail and rain occurred about noon, with very low temperature. About 4 p.m. the wind was awful; at this time a large brick chimney, 14 feet in height, above, the roof of a house in Market-street fell, and demolished the plate glass front of Greenish and Dawkins's, Market-street. Sad havoc took place with the roofs of houses, ten fine elms of 150 years growth succumbed, hedge and all, during the succeeding hours of the evening. A very fine old elm, believed to be more than two centuries old, fell with a fearful crash, (8 p.m.) narrowly escaping demolishing a house just opposite it. The damage done in the country is immense; 1000 trees are estimated to have fallen at Picton, 300 at Withybush, and lesser numbers at numerous other places. Without doubt this is one of the greatest storms in living memory; it is thought that no such gale has visited Milford during the last 70 years!

Barometric readings during the storm, 8th December, corrected for temp., reduced to M. S. L. :—

9.30 a.m.	28·462
1.30 p.m.	28·356
2.30 p.m.	28·288
4.25 p.m.	28·215
5.30 p.m.	28·209
9.15 p.m.	28·265

No considerable variation took place from this last reading for several hours; about 3 a.m. (9th) an aneroid by my bedside registered 28·430; in the morning it still blew with terrific violence at times.

EDWARD PICTON PHILLIPS.

Haverfordwest.

The storm swept across the Isle of Wight with terrible fury. Near Freshwater a toll-gate was blown down, and at Rookley the "Checkers Arms" public-house shared a like fate. The booking office of Merston railway station was literally swept off the platform, tickets and papers being carried over fields to the village.

Early on Wednesday morning I found that at this altitude pressure was lower than the range of Richard's Barograph and it became necessary to start hourly readings of the Kew Barometer, which I kept up till 9 p.m. on the 9th, thus making 40 consecutive hourly readings. There was certainly only *one min.* here, which occurred *exactly at 8 p.m.* on December 8th. Of this I can speak with confidence, for when it became evident that the min. was to be unusually low I set the vernier *every 10 minutes* between 4 p.m. December 8th and 1 a.m. December 9th. When once the rise began it continued without interruption.

We certainly had a fair amount of wind, but not at all serious, indeed quite insignificant beside the great storm of January 26, 1884.

Robinson's Anemometer gave 550 miles between 9 a.m. December 8th and the same hour on the 9th.

THOS. G. BENN.

Newton Reigny, Penrith.

THE CAUSE OF THE VEERING OF THE WIND.

To the Editor of the Meteorological Magazine.

SIR,—I suppose no one doubts that the reason why, in stormy weather in these islands, the wind more frequently veers than backs is that the paths of cyclonic centres lie more frequently in the north than in the south. The difference between Mr. Backhouse and myself is as to whether the same explanation can be applied to the prevalence of veering over backing which we both believe is observable in settled weather. I think it can be so applied. But in applying it to the case of the alternation of land and sea breezes, it is not necessary to suppose that a distant centre in the north is able of itself to cause the wind to veer through half the compass. If it should operate to the extent of a few points only, it would, as it seems to me, be sufficient to bring about the result that an easterly wind in becoming westerly would change more frequently through the south than through the north, and that a westerly wind in becoming easterly would change more frequently through the north than through the south.

My own observations, with a study of the published charts, have led me to believe that the influence of cyclonic systems in determining

the direction of the wind extends far beyond the region of unsettled weather, and I am inclined to think that the so-called anti-cyclones are best regarded as but inter-spaces between cyclones, the supposed *direct* circulation of the air within an anti-cyclone being, in my view, nothing more than the combined result of the *retrograde* circulations belonging to the surrounding cyclones.

Possibly it might be more philosophical to explain the veering of the wind in every case directly by the rotation of the earth, which doubtless lies at the root of the whole matter; but if this be granted, it need not on that account be incorrect to refer each individual instance to some particular cyclonic system.

In the foregoing remarks I have used the term "cyclone" in its most comprehensive sense. Originally the word conveyed the idea of a destructive West Indian hurricane, but the progress of meteorology has made it convenient to include under the same name all systems of circulation of air about a centre of barometric depression. When words change their meaning it is well to take note of the fact.

GEORGE F. BURDER, M.D.

Clifton, 1st Dec., 1886.

ROYAL METEOROLOGICAL SOCIETY.

The first meeting of this Society for the present session was held on Wednesday evening, Nov. 17th, at the Institution of Civil Engineers, 25, Great George-street. Mr. W. Ellis, F.R.A.S., President, in the chair.

The following gentlemen were elected Fellows, viz:—Messrs. B. A. Dobson, T. Gordon, H. Mantle, F. Wright, and the Rev. J. Watson.

The papers read were:—

(1) "The Gale of October 15th-16th, 1886, over the British Islands," by Mr. C. Harding, F.R.Met.Soc. The storm was of very exceptional strength in the west, south-west, and south of the British Islands, but the principal violence of the wind was limited to these parts, although the force of a gale was experienced generally over the whole kingdom. The storm appears to have been formed about 250 miles to the south-east of Newfoundland on the 12th, and was experienced by many ocean steamers on the 13th. When the first indication of approaching bad weather was shewn by the barometer and wind at our western outposts, the storm was about 500 miles to the west-south-west of the Irish coast, and was advancing at the rate of nearly 50 miles an hour. The centre of the disturbance struck the coast of Ireland at about 1 a.m. on the 15th, and by 8 a.m. was central over Ireland. The storm traversed the Irish Sea and turned to the south-east over the Western Midlands and the Southern Counties of England, and its centre remained over the British Isles about 34

hours, having traversed about 500 miles. The storm afterwards crossed the English Channel into France. It subsequently again took a course to the north-eastwards, and finally broke up over Holland. In the centre of the storm the barometer fell to 28·5 in., but, as far as the action of the barometer was concerned, the feature of principal importance was the length of time that the readings remained low. At Geldeston, not far from Lowestoft, the mercury was below 29 in. for 50 hours, and at Greenwich it was similarly low for 40 hours. The highest recorded hourly velocity of the wind was 78 miles from N.W. at Scilly on the morning of the 16th, but on due allowance being made for the squally character of the gale, it is estimated that in the squalls the velocity reached for a minute or so the hourly rate of about 120 miles, which is equivalent to a pressure of about 70 lbs. on the square foot. On the mainland the wind maintained a velocity of about 60 miles an hour for a considerable time, but without question this velocity would be greatly exceeded in the squalls. In the eastern parts of England the velocity scarcely reached 30 miles in the hour. The gale was very prolonged. At Scilly the velocity was above 30 miles an hour for 61 hours, and it was above 60 miles for 19 hours, and at Falmouth it was above 30 miles an hour for 52 hours. The erratic course of the storm and its slow rate of travel whilst over the British Islands was attributed to the presence of a barrier of high pressure over northern Europe. The rainfall in Ireland, Wales, and the south-west of England was exceptionally heavy. In the neighbourhood of Aberystwith the fall on the 15th was 3·83 in., and at several stations the amount exceeded 2·00 in. Serious floods occurred in many parts of the country. A most terrific sea was also experienced on the western coasts, and in the English Channel, and the number of vessels to which casualties occurred on the British coasts during the gale, proves its violence. The total number of casualties to sailing vessels and steamships was 158, and among these were 5 sailing and 1 steam ship abandoned, 5 sailing and 1 steam ship foundered, and 42 sailing and 2 steam ships stranded.

(2.) "The Climate of Carlisle," by Mr. T. G. Benn, F.R.Met.Soc. This is a discussion of the observations made at the Carlisle Cemetery. The mean temperature for the 23 years 1863—85 was 47°·5 ; the absolute highest was 95°·0 on July 22nd, 1873, and the lowest —5°·5 on January 16th, 1881. The mean annual rainfall was 29·80 in. ; the greatest monthly fall was 7·84 in. in July, 1884, and the least 0·30 in. in January, 1881. The average number of rainy days was 174.

(3.) "Results of Hourly Readings derived from a Redier Barograph at Geldeston, Norfolk, during the four years ending February, 1886," by Mr. E. T. Dowson, F.R.Met.Soc.

(4.) "Results of Observations taken at Delanasau, Bua, Fiji, during the five years ending December 31st, 1885, with a summary of results for ten years previous," by Mr. R. L. Holmes, F.R.Met.Soc.

THE RECENT SUMMER AND THE WEATHER CYCLISTS.

To the Editor of the Meteorological Magazine.

SIR,—With reference to Mr. Ryves's letter, p. 148 in the last issue of the *Meteorological Magazine*, I beg leave to remark that although the recent summer cannot be said to have been hot all over the country, it has been considerably warmer than the average in and near London.

The temperature of the "summer" quarter (July—September) at the Royal Observatory, Greenwich, was 61°·2, and 1°·5 and 0°·7 warmer than the averages of the last 115 years and 45 years respectively, each month being above its average. The mean daily maximum temperature was also higher than the average in each month of the quarter.

Although at Greenwich the highest "shade" temperature did not reach 90°·0, it rose above 89°·0 on three days, viz :—

On July	6, max. was	89°·8
,, July	7, ,,	89 ·5
,, Aug.	31, ,,	89 ·1

Temperatures exceeding 87°·0 (the maximum given by Mr. Ryves) occurred on several days.

I consider, therefore, that in London and the neighbourhood Mr. Brumham's predictions of "spells of excessive heat" have been fully verified.—I am, Sir, yours truly,

G. T. GWILLIAM.

35, *Lansdowne-crescent, W., Nov.* 23.

SIR,—I have just read Mr. Ryves's letter in your Magazine, and find his remarks as to the temperature of the past summer at variance with my own observations, supposing that he includes this district in the "North-West of England." I send a statement of the mean temperature of every month of this year, to the end of October, and also the means for the last 14 years.

I entirely agree with the remarks in his last paragraph as to cyclist predictions, and also with his statement that we have had few or no days of exceptional heat this year.—Yours, &c.,

S. KING.

Elswick Lodge, near Poulton-in-the-Fylde.

	Mean of 14 years.	1886.	Difference.
January	36°·9	34°·3	—2·6
February	38 ·4	34 ·3	—4·1
March	40 ·0	38 ·2	—1·8
April	45 ·3	45 ·6	+ ·3
May	49 ·4	49 ·9	+ ·5
June	55 ·2	55 ·9	+ ·7
July	58 ·2	59 ·0	+ ·8
August	57 ·8	59 ·5	+1·7
September	53 ·3	55 ·0	+1·7
October	46 ·3	50 ·4	+4·1

To the Editor of the Meteorological Magazine.

SIR,—In my letter published in your June number, I predicted that "the summer of this year" should resemble that of "17 years ago;" that it ought, for that reason, among others, "to give us some periods of excessive heat;" and, that the summer should be "a warm one of long duration like that of 1869" (when the hot weather continued until the 13th October, and the summer lasted, according to the Greenwich report, until the 16th of that month, as it did this year). I said, too, that "the summer of 1801 was very hot in August and September" (Mr. Ryves, in his letter to you, omits any allusion to September and limits the summer to the usual "thirteen weeks"), and that, excessive heat returned, "after an interval of 17 years—in 1818, 1835, and 1852." I may here remind your readers that the cycles of 68, 136, and 425 years, to which I referred in my letter, are all multiples of 17. I also said that "we ought to have some waves of very great heat during the summer" (I did not say, as Mr. Ryves seems to infer, that the heat waves would be frequent) "notwithstanding the adverse influence of the late severe winter." (Mr. Ryves is, I think, unfair, and omits to notice my reference to this qualifying influence.) The truth is, a cold March, such as we had in 1869 and in the present year, almost always prevents the summer being more than a "warm" one for a long time, with "some periods of excessive heat."

All my predictions were fulfilled. In July the shade heat at Greenwich rose to 89°·8, which is practically 90°·0 (not 87°·0 as erroneously stated by Mr. Ryves), and, according to your Boston observer, the maximum air temperature was as high as 95°·0. On another day in July, the max. temp. at Greenwich was 89°·5. In August, too, a wave of great heat occurred, and the highest shade reading of the thermometer at Greenwich was 89°·1; and on the 1st September the shade temp. there rose to nearly 88°·0. In October we had another wave of excessive heat recorded at Greenwich, when the max. temp. and extreme daily mean temperatures were higher than in any October for, at least, 72 years past.

Now, as the late summer has been a repetition of that of 1869, it follows that, if Mr. Ryves still denies that it was a warm one, he must, at the same time, dispute the assertion of meteorologists, that "a warm summer of long duration" occurred in 1869. Anyhow, the 17 years' cycle theory is vindicated.

"Perhaps the best comment" on Mr. Ryves' criticism is the following statements in parallel columns :—

WEATHER AT GREENWICH, MARCH TO OCTOBER, 1869.

The summer of 1869 did not terminate until the 16th October.

March was remarkably cold.

In March and April rain fell on 27 days to the amount of 2·4 in.

May was remarkably wet and cold.

June was a very cold month, especially about the 17th and 21st. On two days, however, the max. temp. was over 80°·0. It was also dry.

Total rainfall in May and June, 4·5 in.

Total rainfall in August, 1·21 in.

Total rainfall in July, August, and September, 4·9 in.

In July the max. shade temp. was 90°·9.

In August the highest temp. of the air was 89°·0.

On five days the max. shade readings were above 87·0 during the ordinary summer period (June to August inclusive).

There were 15 days when the max. shade temp. was almost exactly 80°·0 or above during the protracted summer, which lasted up to the 16th October.

There were 42 days when the max. shade temp. was as much as 75°·0 or above, in the period from April to October inclusive.

Mean. temp. of June to September inclusive, about 60°·0.

Mean temp. of July to September inclusive, 61°·5.

Mean temp. of period from June 1st to 13th October, 60°·9.

Mean temp. of period from June 1st to October 16th, 60°·6.

The mean temp. of the first 13 days of October was slightly over 57°·0.

WEATHER AT GREENWICH, MARCH TO OCTOBER, 1886.

The summer of 1886 did not terminate until the 16th October.

March was remarkably cold to the 19th.

In March and April rain fell on 27 days to the amount of 2·4 in.

May was remarkably wet.

June was a very cold month, especially about the 18th and 21st. On two days, however, the max. temp. was over 80°·0. It was also very dry.

Total rainfall in May and June, 4·7 in.

Total rainfall in August, 1·12 in.

Total rainfall in July, August, and September, 4·9 in.

In July the max. shade temp. was about 90°·0 (89°·8).

In August the highest temp. of the air was 89°·1.

On five days the max. shade readings were above 87°·0 during the ordinary summer period (June to August inclusive). This year, however, the max. temp. was almost 88°·0 on the 1st September.

There were 15 days when the max. shade temp. was above 80°·0 during the protracted summer, which lasted up to the 16th October.

There were 42 days when the max. shade temp. was as much as 75°·0 or above, in the period from April to October inclusive.

Mean temp. of June to September inclusive, 60°·4.

Mean temp. of July to September inclusive, 61°·3.

Mean temp. of period from June 1st to 13th October, 60°·8.

Mean temp. of period from June 1st to October 16th, 60°·5.

The mean temp. of the first 13 days of October was slightly over 57°·0.

Can any rational man really believe that the above-mentioned statements refer only to "mere coincidences"? To me they reveal a recurrence quite as remarkable as I had dared to anticipate, and more convincing than I suppose my critical friend will like to admit.

Is it to be supposed that, as there are lunar-cycles, planetary-cycles, sun-spot-cycles, in fact, cycles almost wherever we look, that there are no weather-cycles? It cannot be so supposed, with any show of reason. If Mr. Ryves could imitate certain ecclesiastical obstructers of science, and could torture me into confessing, on my knees, that the weather did not move in cycles, when I rose to my feet, I should say like poor Galileo, "*E pur se muove.*" For all this, it does move! or, rather: For all this, it does move so!—Yours truly,

GEORGE D. BRUMHAM.

Barnsbury, Nov. 30, 1886.

REVIEW.

Negretti and Zambra's Encyclopœdic, Illustrated and Descriptive Reference Catalogue of Optical, Mathematical, Physical, Photographic, and Standard Meteorological Instruments. Revised and Corrected Edition. Roy. 8vo. London, 1886. X—602 pages.

THIS is in some respects a wonderful book, for it justifies all the adjectives heaped together in the title. We must, however, deal only with the first 175 pages devoted to meteorological instruments, and of course we must say nothing as to either quality or price. Our duty, in fact, is to consider the catalogue from two points—its utility to meteorologists, and its accuracy as a literary and scientific work.

In our opinion, it is a book decidedly useful to meteorologists, and we think that the firm would render a service both to themselves and to meteorologists, if they issued the meteorological part of the catalogue separately, at a low price.

As regards accuracy there is little to complain of, except that the author, following bad precedents, seems sometimes to forget by whom instruments were invented, and claims for the firm designs generally believed to belong to other persons. For instance, on page ii., among the "Inventions and Improvements" claimed for the firm are—

14. Improved Self-recording Barographs, Thermographs, Hygrometers. (See pages 30, 53 to 56, 130.)

But p. 30 is devoted to the Jordan-Ronalds-Beckley Barograph, and we do not know what Negretti & Zambra had to do with its invention; nor can we find any invention of theirs either under *number* 130 or on *page* 130.

Again, on p. 27, under the heading "Negretti and Zambra's Self-Recording Aneroid Barometers," we have an engraving of Richard Frères' portable barograph.

A firm with so grand a record as Negretti & Zambra loses rather than gains by statements like these, and he was no true friend to the firm who put its name on Fig. 28.

The printing is generally both clear and accurate—in fact, the volume is almost an *edition de luxe*, and there are some charming new instruments, *e.g.*, the "turnover" thermometer engraved on p. 78

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1886.

STATIONS. *(Those in italics are South of the Equator.)*	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	75·3	7	31·6	1	62·9	44·6	43·9	72	115·8	23·7	4·79	19	6·0
Malta	87·0	29	48·0	7	71·9	56·9	55·6	75	140·5	42·7	·55	3	3·4
Cape of Good Hope	84·0	2	37·2	17	68·4	47·8	50·2	86	...	...	2·40	9	4·0
Mauritius	80·3	6	63·0	8	77·3	67·4	61·5	71	129·3	53·8	1·88	19	5·2
Calcutta	100·5	11	68·4	13	93·6	76·9	76·2	77	158·5	66·1	7·93	13	4·1
Bombay	93·5	26	79·0	4	90·7	81·2	76·7	75	148·7	68·9	·96	6	4·3
Ceylon, Colombo	90·8	13	74·8	5, 20	87·0	78·4	75·7	79	147·6	59·7	22·28	21	8·1
Melbourne	76·6	8	32·7	29	61·0	45·0	43·6	72	120·1	23·6	·80	10	6·7
Adelaide	73·5	16	37·7	31	64·8	49·5	44·6	63	131·1	29·3	1·09	16	6·1
Wellington	63·0	12	39·5	26	56·5	47·2	46·8	84	116·0	37·0	10·83	16	6·0
Auckland	67·0	12*a*	46·0	30	62·5	50·8	49·2	76	125·0	35·0	2·39	13	5·5
Jamaica, Kingston	...	...	...	...	...	...	...	...	...	...	...	...	...
Barbados	84·0	var.	69·0	10	83·0	72·0	70·4	75	145·0	...	3·14	18	5·0
Toronto	78·5	22	35·1	17	62·4	43·5	43·1	69	...	25·5	2·44	8	5·0
New Brunswick, Fredericton	74·8	23	30·0	11	62·0	39·6	42·5	73	...	...	3·65	14	5·7
Manitoba, Winnipeg	84·8	27	19·0	6	68·0	38·7	40·4	62	...	...	1·19	15	5·1
British Columbia, Victoria	74·0	25	36·0	1, 4	61·7	44·0	...	...	...	...	·45	6	...

a And 13.

Remarks, May, 1886.

Malta.—Mean temp. 63°·4; mean hourly velocity of wind 8·5 miles; velocity averaged 24 miles per hour from 8 a.m. to noon on 3rd. TS on 1st. J. Scoles.

Mauritius.—Rainfall 3·00 in. and mean temp. 1°·1 below average; pressure ·036 in above average. Mean hourly velocity of wind 13 miles; extremes 26·8 miles on 12th and 2·2 miles on 18th; prevailing direction S.E. by E. C. Meldrum, F.R.S.

Colombo.—TSS on 5 days; T on 6th; L on 12th.
F. H. Clarke, Lt.-Col. R.A.

Melbourne.—Mean temp. of air 0°·5, of dew point 2°·4; rainfall 1·32 in. and humidity 6 below average; mean amount of cloud 0·2 and pressure ·045 in. above average. Prevailing winds N. and W., strong on 7 days; heavy dew on 6 days, hoar frost on 5, L on 1. R. L. J. Ellery, F.R.S.

Adelaide.—Mean pressure considerably above and mean temp. slightly below average; mean amount of cloud about average; rainfall very small, the fall from January 1st to May 31st being the smallest since 1839. C. Todd.

Wellington.—Very showery, unpleasant weather from 1st to 20th; 3·40 in. of R on 14th; strong wind on 15th and 16th, 19th and 20th; remainder of month fine, with wind usually light. Rainfall 6·12 in. and pressure ·079 in. above average; mean temp. 1°·1 below. T and H on 3rd; fog on 9th, 10th, and 11th; slight earthquake on 16th. R. B. Gore.

Auckland.—Early part of the month showery and unsettled; remainder fine, clear, and bright. R considerably below average; mean temp. about average; pressure above it. T. F. Cheeseman.

Barbados.—The month was fine throughout. Mean temp. (76°·6) same as the average Prevailing wind N.E.; mean hourly velocity 11·3 miles; R much below average. T on 15th, 16th, and 17th; L on 31st. R. Bowie Walcott.

SUPPLEMENTARY TABLE OF RAINFALL, NOVEMBER, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	3·97	XI.	Castle Malgwyn	6·30
,,	Margate, Birchington...	3·17	,,	Rhayader, Nantgwillt..	7·68
,,	Littlehampton	3·90	,,	Carno, Tybrith	5·50
,,	Hailsham	5·18	,,	Corwen, Rhug	2·35
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	7·41
,,	Alton, Ashdell.....	3·57	,,	I. of Man, Douglas	4·72
III.	Winslow, Addington ...	2·56	XII.	Stoneykirk, Ardwell Ho.	3·85
,,	Oxford, Magdalen Col...	2·50	,,	Melrose, Abbey Gate ...	4·44
,,	Northampton	1·67	XIII.	N. Esk Res. [Penicuick]	3·50
,,	Cambridge, Beech Ho...	2·32	XIV.	Ballantrae, Glendrishaig	4·46
,,	Wisbech, Bank House..	2·76	,,	Glasgow, Queen's Park.	3·42
IV.	Southend	...	XV.	Islay, Gruinart School..	3·52
,,	Harlow, Sheering	2·97	XVI.	St. Andrews, Pilmour Cot	2·08
,,	Rendlesham Hall	2·86	,,	Balquhidder, Stronvar..	7·75
,,	Diss	2·57	,,	Dunkeld, Inver Braan..	3·62
,,	Swaffham	2·55	,,	Dalnaspidal H.R.S. ...	6·46
V.	Salisbury, Alderbury ...	3·32	XVII.	Keith H.R.S.	3·89
,,	Warminster	3·71	,,	Forres H.R.S.	2·53
,,	Calne, Compton Bassett	3·48	XVIII.	Strome Ferry H.R.S....	8·67
,,	Ashburton, Holne Vic..	5·71	,,	Tain, Springfield.....	2·63
,,	Holsworthy, Clawton...	4·39	,,	Loch Shiel, Glenaladale	11·77
,,	Hatherleigh, Winsford.	...	,,	S. Uist. Ardkenneth ...	5·34
,,	Lynmouth, Glenthorne.	4·86	,,	Invergarry	8·66
,,	Probus, Lamellyn	4·56	XIX.	Lairg H.R.S.	...
,,	Wincanton, Stowell Rec.	4·19	,,	Forsinard H.R.S.	2·80
,,	Taunton, Lydeard Ho ...	3·48	,,	Watten H.R.S.	2·48
,,	Wells, Westbury.....	5·48	XX.	Dunmanway, Coolkelure	6·41
VI.	Bristol, Clifton	4·08	,,	Fermoy, Gas Works ...	3·94
,,	Ross	2·51	,,	Tralee, Castlemorris ...	4·83
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	1·82
,,	Cheadle, The Heath Ho.	2·35	,,	Newcastle West	...
,,	Worcester, Diglis Lock	1·83	,,	Miltown Malbay.....	5·46
,,	Coventry, Coundon	2·44	XXI.	Gorey, Courtown House	2·59
VII.	Melton, Coston	2·25	,,	Navan, Balrath	1·96
,,	Ketton Hall [Stamford]	2·82	,,	Mullingar, Belvedere ...	2·29
,,	Horncastle, Bucknall ...	2·35	,,	Athlone, Twyford	2·81
,,	Mansfield, St. John's St.	1·87	XXII.	Galway, Queen's Coll...	4·37
VIII.	Macclesfield, The Park.	2·73	,,	Clifden, Kylemore	7·64
,,	Walton-on-the-Hill.....	3·04	,,	Crossmolina, Enniscoe..	7·08
,,	Lancaster, South Road.	...	,,	Collooney, Markree Obs.	4·14
,,	Broughton-in-Furness ..	7·14	,,	Carrick-on-Shannon ...	3·99
IX.	Wakefield, Stanley Vic.	1·20	XXIII.	Rockcorry.....	3·37
,,	Ripon, Mickley	3·21	,,	Warrenpoint	2·88
,,	Scarborough.....	2·25	,,	Newtownards	2·86
,,	East Layton [Darlington]	3·24	,,	Belfast, New Barnsley..	4·85
,,	Middleton, Mickleton ..	4·25	,,	Cushendun	5·01
X.	Haltwhistle, Unthank..	4·64	,,	Bushmills	3·55
,,	Shap, Copy Hill	6·38	,,	Stewartstown	2·86
XI.	Llanfrechfa Grange	4·17	,,	Buncrana	4·17
,,	Llandovery	6·33			

NOVEMBER, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·71	+ ·27	·54	5	14	58·8	1	30·0	23	3	17
II.		Maidstone (Hunton Court)...	2·94	+ ·04	·40	10	17	...	...	...	...	...	...
,,		Strathfield Turgiss	3·25	+ ·50	·98	5	15	59·3	1	25·0	23	6	15
III.		Hitchin	3·21	+ ·60	·84	11	18	57·0	1	26·0	23	5	...
,,		Banbury	2·15	— ·56	·59	11	15	56·0	1	26·5	8, 19	8	...
IV.		Bury St. Edmunds (Culford)	2·70	— ·13	·49	10	17	59·0	1, 9	24·0	30	8	...
,,		Norwich (Cossey)	2·74	— ·57	·57	12	13	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	3·13	...	·74	8	20	59·0	2	33·0	24	0	...
,,		Barnstaple	5·06	+ ·91	·72	5	24	58·0	1, 2*a*	35·0	8	0	...
,,		Bodmin	3·73	— 1·59	·52	5	20	54·0	1	32·0	9	1	6
VI.		Stroud (Upfield)	2·89	— ·05	·45	5	16	58·0	1, 16	28·0	30	3	...
,,		ChurchStretton(Woolstaston)	2·42	— 1·02	·54	9	21	54·0	2	32·0	8	1	7
,,		Tenbury (Orleton)	2·29	— ·57	·57	5	19	58·0	1	24·7	8	...	...
VII.		Leicester	1·99	...	·43	10	19	58·6	1	28·5	22	4	19
,,		Boston	2·84	+ ·47	·94	10	13	60·0	14	28·0	19*d*	5	...
,,		Hesley Hall [Tickhill].....	1·26	...	·43	5	15	57·0	1	29·0	22*e*	6	...
VIII.		Manchester (Ardwick).....	2·15	— ·82	·94	5	19	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ...	1·96	— ·80	·69	5	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·14	— ·61	1·26	5	26	54·0	4	29·0	7	...	...
,,		Hull (Beverley Road)	1·57	— 1·45	·57	5	15	56·0	1	31·0	19*f*	5	8
X.		North Shields	2·86	— ·59	1·23	5	11	56·0	20	29·8	19	6	10
,,		Borrowdale (Seathwaite).....	14·78	+ 2·96	2·23	3	24	53·9	3	31·0	25	1	...
XI.	WALES.	Cardiff (Ely).....	5·59	+ 1·39	1·11	8	23	...	...	...	...	...	...
,,		Haverfordwest	6·98	+ 1·64	1·29	5	28	57·0	2	32·0	7	1	4
,,		Plinlimmon (Cwmsymlog) ...	6·53	...	1·20	5	20	...	...	...	...	...	...
,,		Llandudno.....	3·83	— ·08	1·22	5	21	57·1	3	39·0	29	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·67	— ·24	·53	1	20	54·0	20	31·0	22	3	...
,,		Jedburgh (Sunnyside).....	3·11	+ ·10	1·32	5	18	54·0	24	28·0	22	3	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	..	...	...
XV.		Lochgilphead (Kilmory)	8·34	+ 2·98	1·38	18	21	...	...	31·0	6	8	...
,,		Oban (Craigvarren)	5·57	...	·75	2	24	55·9	19	36·0	16*g*	0	...
,,		Mull (Quinish).....	7·17	...	·69	2	27	...	...	...	...	...	...
XVI.		Loch Leven Sluices	2·20	— 1·35	·30	4, 12	14	...	...	...	...	...	...
,,		Arbroath	2·26	— ·89	·75	5	12	55·0	20	31·0	22	1	...
XVII.		Braemar	4·17	+ ·40	·71	10	17	53·0	20	28·8	22	7	19
,,		Aberdeen	2·14	...	·38	6	19	55·0	20*b*	31·0	30	2	...
XVIII		Lochbroom	5·89	...	·84	29	22	...	...	...	...	...	...
,,		Culloden	2·31	— ·39	...	...	...	54·0	3*h*	31·0	22	1	16
XIX.		Dunrobin	...	...	...	...	...	...	...	...	...	...	...
,,		Kirkwall (Swanbister)..... ..	...	...	...	...	...	...	...	...	...	...	...
XX.	IRELAND.	Cork (Blackrock)	2·23	— 2·38	·44	11	18	58·0	23	27·0	8	3	...
,,		Dromore Castle	4·64	...	·64	11	17	59·0	24	30·0	8	...	...
,,		Waterford (Brook Lodge) ...	2·95	...	·53	8	16	56·0	3	29·0	8	5	13
,,		Killaloe	3·40	...	·44	3	22	64·0	22	28·0	9	3	...
XXI.		Carlow (Browne's Hill)	2·94	+ ·02	·52	8	23	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·18	— ·10	·45	5	18	58·5	3	3·1	7	0	6
XXII.		Ballinasloe	3·55	+ ·55	·73	14	22	53·0	19*c*	2 0	9	8	...
XXIII		Waringstown	3·18	+ ·47	·58	8	16	56·0	23	2·0	25	5	13
,,		Londonderry (Creggan Res.).	4·73	...	·62	14	23	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·28	+ ·23	·53	11	22	54·0	19	31·0	20	3	9

a And 20. *b* And 25. *c* And 20, 29. *d* And 23. *e* And 26. *f* And 22, 26. *g* And 10, 20, 30. *h* And 15, 23.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON NOVEMBER, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain ;H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The early and middle portions of the month were wet, with few intervals of fine weather. Serious floods occurred in places, and everywhere wheat sowing was in arrear. The close of the month was on the whole much drier, with one or two sharp frosts at night. Wheat was well out of the ground at the close and looking very strong and healthy.

CULFORD.—The early part of the month was generally unsettled and stormy, with high winds.

LANGTON HERRING.—Rainfall ·51 in. below the average of 11 years. In the six weeks from October 8th to November 19th there were only three days on which R did not fall. The mean temp. at 9 a.m. was 1°·9, the mean max. 1°·6, and the mean min. 0°·7 above the average. A steady N.E. wind blew from 22nd to 27th inclusive.

BODMIN.—A most genial November, with happily no fog; mean temp. 45°·4.

WOOLSTASTON.—A mild and pleasant month; mean temp. 43°·4.

ORLETON.—The first half of the month was very stormy and unsettled, with R almost every day and a few frosty nights, but the temperature was generally high. The latter half of the month was generally cloudy, foggy, dark, and sunless, with very little R and high pressure. Mean temp. about 2°·5 above the average of 25 years; S on 30th.

HULL.—On the whole a fine bright month, but very foggy from 22nd to 28th.

WALES.

HAVERFORDWEST.—A month of excessive rainfall, extreme humidity and gloom, and much milder than the average November; at times very stormy and wet, especially on 5th and 8th. Towards the close the air became colder, with strong N.W. gales, accompanied by R and H; S covered the Precelly Hills at the close.

LLANDUDNO.—The month was mild and the temperature unusually equable. The mean temp. (47°·4) was 2°·3 above the average. The mean daily range (6°·7) was 2°·4 and the total range (18°·1) no less than 9°·2 below the average. I believe I never recorded such a degree of equality at this or any other season of the year since observations were commenced in 1861. The min. temp. ranged high till the 20th, when the lowest was reached. The mildness of the weather was further shown by the condition of the flora. Up to the very end of the month tender plants were growing and in full flower in the open air. The first two days excepted, which were very fine, wind and rain were rather prevalent up to the 10th. There was a strong gale from the S.W. on the 3rd, followed by R, and another of about equal strength and longer duration beginning on the afternoon of the 5th and lasting till the evening of the 6th; this was accompanied by very heavy R, the greater part of which fell during the night of the 5th. Fog on 25th; H on 30th.

SCOTLAND.

CARGEN.—A very dull, gloomy month. Mean temp. (43°·1) 1°·7 above the average. There was great want of sunshine. Of the first 20 days of the month, R fell on 17. Grass and turnips made great growth throughout the month, and so many plants have seldom been seen in flower so late in the season.

OBAN.—The month came and went in tempestuous weather. A period of cold at the commencement was succeeded by unnatural warmth from 18th to 28th, when a large depression broke up the weather. During this period spring flowers came into bloom and grass freshened into bright green. A good potato crop was secured. H on 3rd, 4th, 16th, and 30th; T and L on 3rd.

QUINISH.—Stormy, unsettled weather prevailed until the 20th, after which it was warm and calm with much fog.

BRAEMAR.—A very wet, dull month; harvest secured in bad order.

ABERDEEN.—Rainfall about one inch below the average. T and Li on 9th; S on 30th; aurora on 5 nights.

LOCHBROOM.—There could scarcely be greater variety of weather than was experienced during this month, though on the whole it was fine and open. Vegetation was as green and fresh at the close as at Midsummer, the trees and bushes not being all stripped of their leaves. From 20th to 28th was as fine as June, but the last three days were very rough and wintry.

CULLODEN.—The weather was favourable for out-door work during the greater part of the month. R in any quantity fell only at intervals, and there was but little frost. L was seen on several nights.

IRELAND.

BLACKROCK.—With the exception of 9 fine days, the month was very damp and dull, and often misty. Mean temp. (45°·6) 2°·2 above the average.

WATERFORD.—The latter part of the month was most favourable for farm work, and very mild. Rainfall ·85 in. below the average.

KILLALOE.—The rainfall was moderate for November, and pressure from 17th to 23rd was unusually high.

DUBLIN.—A mild, open month, but generally dull and damp. R fell frequently but the amounts were on no occasion very large. Temperature was singularly high during the fourth week. The mean temperature was two degrees above the average. Pressure was ·020 in. above the average, and higher on the 24th than it had been since March 5th, 1883. The rainfall and number of rainy days were both somewhat below the average. Solar halo on 1st; S and sleet on 9th; H on 10th and 11th. Fog on 7 days; high wind on 8 days; gales on 2 days. A TS with heavy R and H passed a few miles S.E. of Dublin on the 10th. Mean humidity 88; mean amount of cloud 6·5; prevailing winds S.W., W. and N.W.

EDENFEL.—The month throughout was abnormally mild and quiet, with many summerlike days, especially during its latter half.

BAROMETRIC DEPRESSION OF DECEMBER 8TH-9TH.

(Continued from p. 161.)

To the Editor of the Meteorological Magazine.

SIR,—I enclose chart of my Barometric observations, November 15th to December 14th, showing during 14 days the highest and lowest readings registered here during 23 years. I consider the Barometer a first-rate instrument, though without a Kew certificate, and the readings (extraordinary as they seem) were corroborated by those of an excellent aneroid placed beside the Mercurial instrument. They are uncorrected for altitude, 285 ft. or temp. 41°. [The sea level pressures are approximately, December 8th, 9 a.m. 27·80; 1 p.m. 27·24]. During the period of greatest depression 1 p.m. on 8th, an almost dead calm prevailed here, and continued till about 1 a.m. next morning, when there followed violent intermittent gales from the North West to which point the wind had backed from S.E. at a former period.

L. M. BUCHANAN.

Edenfel, Omagh, Tyrone.

SYMONS'S

MONTHLY

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THE SNOWSTORM OF DECEMBER 26TH.

IT is not easy to imagine a more severe test of the discipline of the body of rainfall observers than was thrust upon them at the end of December. A very deep drifting snow puzzles even the best observers in spite of Rule XV.,* but a mixture of snow and rain is worse still; that was what came on December 26th, and I need hardly describe the interest with which I have compared the results obtained.

At present I know of no record equally well kept with that by Mr. Baldwin Latham, C.E., at Croydon, and I therefore insert it first.

"SIR,—I dare say you will be interested in the returns, which I give you below, of the heavy fall of snow on the 26th and 27th inst. as recorded in my registering rain-gauge at Croydon.

"The gauge is 4 ft. above the ground and 259 ft. above sea level.

	Time.		Inches.	
December 26th.	11.30 a.m.	to 12 noon	·01	
	0 p.m.	„ 1 p.m.	·025	
	1 „	„ 2 „	·01	
	2 „	„ 3 „	·03	
	3 „	„ 4 „	·01	
	4 „	„ 5 „	·05	
	5 „	„ 6 „	·075	
			———	·210 rain
	6 „	„ 7 „	·06	
	7 „	„ 8 „	·06	
	8 „	„ 9 „	·12	
	9 „	„ 10 „	·22	
	10 „	„ 11 „	·17	
	11 „	„ 12 a.m.	·235	
December 27th.	0 a.m.	„ 1 „	·24	
	1 „	„ 2 „	·35	
	2 „	„ 3 „	·02	
	3 „	„ 4 „	nil	
	4 „	„ 5 „	·005	
			———	1·480 snow
		Total		1·690

* Arrangements for the Systematic Observation and Record of the Rainfall the British Isles, by G. J. Symons, F.R.S. *Gratis.*

"Probably the increased quantity recorded between one and two o'clock in the morning was partly due to an increased amount of heat which I applied to the gauge, as I found upon examination just before one o'clock, that the snow fell so rapidly as to slightly accumulate in the gauge, and I therefore started a second petroleum stove under it.

"The snow commenced to fall a few minutes before six o'clock in the evening of the 26th inst. Previous to the snow-fall there had been considerable rain during the day, viz. ·210 in. It ceased snowing at 4.20 a.m. on the 27th inst.

"In a gauge 1 ft. from the ground 1·73 in. of snow was collected, and singularly enough in an 8 in. Glaisher gauge, at the same height above the ground and the same level as my registering rain gauge, 1·405 in. was collected. It is curious that such a large quantity should be collected in this gauge, seeing that there is no great capacity for holding snow in these gauges; but in all probability this may be attributed to the fact that the temperature at the time was slightly above freezing. The gauge on the ground was completely covered at nine o'clock in the morning, the snow being 3 in. above the rim.

"I calculate, from observation in my garden, that the average depth of the snow which fell was 15 in. The snow in falling was very wet and was driven by a fierce easterly gale, so that it adhered very tenaciously to all objects with which it came in contact.

"Great destruction of trees and evergreens has occurred in my garden and in the neighbourhood, owing to the combined force of the gale and the weight of the snow.—I am, sir, yours faithfully,

BALDWIN LATHAM."

It is much too soon for me to attempt to compile an exhaustive account of the storm; all that can safely be done is to offer a few facts bearing on several aspects of the question.

Density of the Snow.—Numerous papers in this Magazine and in "British Rainfall," have shown that, as a rough average, 12 in. of snow in England will yield 1 in. of water. But the snow of December 26th and 27th, was in most places very different from ordinary snow—sticky rather than dusty—much wetter than usual, and therefore, excessively heavy. Up to the present time I have the equivalents for

Camden Square	5·7 of snow	= 1 of water	
,, Road	6·8 ,,	= 1 ,,	
Wallington	11·0 ,,	= 1 ,,	
Hersham	6·7 ,,	= 1 ,,	
West Norwood	7·5 ,,	= 1 ,,	
Hartley Grange	5·7 ,,	= 1 ,,	
Charlton House, Salisbury	6·7 ,,	= 1 ,,	

I hope that I shall receive further information on this subject, but from the foregoing it seems evident that the snow generally was nearly twice as dense as usual.

This is very important. A cubic foot of water weighs 62½ lbs., one sixth of that is a trifle over 10 lbs.—therefore it is evident that every foot of snow weighed 10 lbs. Is it at all remarkable that so great a load broke down a few buildings, and was ruinous to trees and to telegraph wires? Take one of the latter, assume the length of span to be 100 yards, and that the wire was coated so that it became 1 in. in diameter—a low estimate—the load would then be 3600 × ·7854 = 2827 in. or 16 lbs.; if it became 2 in. in diameter it would become 64 lbs., and this, be it remembered, on one wire, and on a span of only 300 ft.; when this is applied to long spans and to posts with 10 or more wires, all surprise at the downfall of the posts ceases.

Total Depth.—It is not easy to separate the fall of rain and of snow—the latter was almost water, and the former almost ice, and the two were so mingled that it is difficult to separate them. I believe that the deepest snow was on the high lands of North Hampshire and South Berks, but it rarely exceeded 12 in. in depth except where it had drifted. The yield of rain and snow together seems over the South of England to have averaged 2 in., decreasing steadily northwards to a line from Aberystwith to the Wash, north of which it was quite insignificant.

The Hampshire Downpour.—By far the heaviest fall occurred over South Hampshire, and it is a singular coincidence that two of the Southampton observers independently arrived at practically the same maximum, viz., Red Lodge 3·160, and Highfield 3·157. I think that this local excess was chiefly rain, as gardens were turned into lakes, garden walls washed down, a chasm 15 ft. × 8 ft. cut through a road, the reservoir which supplies Netley Hospital had its bank burst, and sundry other damage occurred, all too soon to be due to melting snow. This heavy fall extended some distance, but I do not know that it exceeded 3 in. at any other stations.

How the observers have stood the test.—It is too early to speak positively, but one fact is worth many opinions. I have taken out the details for about 100 stations in the South of England, laid them down on a map and carefully examined them, 98 appeared to be correct, and two were hopelessly wrong. I think that this is ample proof of the quality of the observers, for if anything would trip up an observer it would be such a fall as this, and to catch only two failures out of 100 is certainly proof of good work.

ENORMOUS SNOWFLAKES, JANUARY 7TH, 1887.

To the Editor of the Meteorological Magazine.

SIR,—During a short snowstorm, suddenly the snowflakes were 2½ in. in length, these produced a dense snow wall 50 yards off. In two minutes they were 2¾ in., one measured 2¾ by 2½, and $\frac{3}{10}$th of an inch thick; at $12^h\ 16^m$ they had increased to 3½ in. (several 4 in., and some not caught were evidently even larger).

A minute before this storm commenced, myself and two assistants were measuring and weighing the snow of this morning's fall, and I had a number of flat circular glasses of 6 in. and 8 in. in diameter kept at the freezing point; we were, therefore, well prepared for experiments. The glasses were so cold that after sketching the outline, and placing each in a cold shed, it took after the storm was over 5 minutes in a hot-house to quite melt the snow.

The large flakes were within 12 in. of each other. When melted the largest yielded 16 drops of water, others 14 and 15. I think that I ought to have added at least another drop for what remained on the glass after no more drops would fall, but I thought that I would be within the mark. The water from seven of those flakes weighed within 2 grains of $\frac{1}{4}$ of an ounce. One flake of $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in. was estimated to be $1\frac{1}{2}$ in. thick before it settled on the glass, on striking the glass it became compressed to $\frac{1}{4}$ of an inch. None of the flakes increased in size on falling on the glass. The flakes were not broken fragments, but composed of hundreds of perfect crystals, at every conceivable angle, more however horizontal than vertical.

The temp. of the air was 32°·6, and of this snow 32°·4 (taken ten minutes afterwards); the fall lasted only from 0.12 to 0.20 p.m.

I never before saw flakes anything like this, they were more than the diameter of oranges.

In the last 6 minutes one-fifth of an inch fell on the glass measure, and this yielded ·030 in. of water (*i.e.*, 1 in. of water to 6 of snow).

The flakes were divided into four classes:—(1) $3\frac{1}{2}$ inches and more; (2) 2 inches; (3) much smaller flakes; (4) very small flakes.

1.	These fell at an angle of	85°	with the velocity of 10 feet in	$1\frac{1}{4}$ seconds.
2.	,,	70°	,,	$1\frac{3}{4}$,,
3.	,,	56°	,,	$2\frac{1}{2}$,,
4.	,,	45°		much slower.

I find that the storm was at least 5 miles wide, as at Chepstow they said the flakes were the largest ever seen.

If the flakes had fallen quite perpendicularly they would I think have been even larger.—Yours truly,

E. J. LOWE.

Shirenewton Hall, near Chepstow.

COLD PERIODS.

To the Editor of the Meteorological Magazine.

SIR,—For the sixth time since our record began in 1849 I have to report 28 days consecutively below 32°, the former instances were—

1885	February.	1878-9.....	December and January.
1860-1.....	December and January.	1879	December.
1870-1.....	December and January.	1886-7.....	December and January.

This is the only instance of a hard winter after a hot summer and autumn.—Yours truly,

W. LUCAS.

Hitchen, 13th January, 1887.

ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on Wednesday evening, the 15th December, at the Institution of Civil Engineers, Mr. W. Ellis, F.R.A.S., president, in the chair.

Mr. G. R. Farncombe, B.A., Mr. C. E. B. Hewitt, B.A., and Capt. S. Trott were balloted for, and duly elected Fellows of the Society.

The following papers were read :—

1. "On the Proceedings of the International Congress of Hydrology and Climatology at Biarritz," by Mr. G. J. Symons, F.R.S. This Congress was held in October, and was divided into three sections, viz., Scientific Hydrology, Medical Hydrology, and Climatology, scientific and medical. The total number of papers read was 109. An exhibition was also held in connection with the Congress. The excursions were of primary importance to the medical men, and extended over a period of three weeks. The places visited were :—Bayonne, Cambo, Dax, Arcachon, Pau, Eaux-Bonnes, Eaux-Chaudes, Cauterets, Lourdes, Bagnères-de-Bigorre, Luchon, Ussat, Ax, Montpellier, Cette, Boulou, Amèlie-les-Bains, La Preste, Banyuls-sur-mer, and Thues.

2. "Report on the Phenological Observations for 1886," by the Rev. T. A. Preston, M.A., F.R.Met.Soc. The weather was on the whole very ungenial, and everything much retarded. It was also very fatal to insect life, so that the complaints on this head have been far less than usual. Bush fruits were *very* abundant; strawberries and peas were spoilt by drought in many places ; stone fruits, except plums, were not abundant ; plums were extraordinarily plentiful, so so much so that they realized nothing in the markets, the cost of picking and carrying often being more than they realized. Apples were very poor from the destruction of the bloom by heavy rain. Hay was good and plentiful, and well harvested. Corn and other grain were not up to an average. Root crops were, as a rule, remarkably good.

3. "A Criticism of certain points of Prof. Langley's Researches on Solar Heat," by Prof. S. A. Hill, B.Sc., F.R.Met.Soc. These experiments were carried out at Mount Whitney, in Southern California, during 1881.

4. "Account of the Hurricane of March 3-4, 1886, over the Fiji Islands," by Mr. R. L. Holmes, F.R.Met.Soc. This storm was the most destructive that has ever been known to occur in the Fiji group. The lowest barometer reading was 27·54 in. at Vuna, in Taviuni. The storm was accompanied by a great wave from 18 to 30 feet in height, which swept over the land and caused an immense amount of damage. It was reported that 50 vessels were wrecked and 64 lives lost during this hurricane.

5. "Results of Meteorological Observations made at the Military Cemetery, Scutari, Constantinople, 1866-85," by Mr. W. H. Lyne. The annual mean temperature is 58°·4 ; the highest temperature registered was 103°·6 on June 22nd, and the lowest 13°·0 on January 25th, both in 1869. The mean rainfall is 29·29 in. ; the greatest fall in one day was 4·06 in. on September 25th, 1866.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1886.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	80·2	29	40·2	5	69·6	49·2	47·1	63	92·6	36·0	·63	8	5·4
Malta	91·2	8	60·1	27	78·7	63·7	60·9	72	138·9	54·1	·07	2	2·4
Cape of Good Hope	76·3	16	39·0	24	64·8	49·0	51·5	89	...	...	7·68	13	6·4
Mauritius	78·4	7	62·2	2	75·4	65·8	59·4	70	123·7	51·4	·65	14	5·6
Calcutta	99·7	4	75·3	17	91·9	79·1	78·6	82	167·0	73·3	11·52	16	7·4
Bombay	91·8	3	75·3	30	87·4	79·4	77·1	81	147·3	74·1	43·45	21	7·5
Ceylon, Colombo	88·4	22	73·3	16	85·8	78·3	73·8	76	146·0	64·0	8·32	19	7·2
Melbourne	63·3	7	33·0	27	57·4	41·8	42·3	78	113·0	23·4	·81	12	6·4
Adelaide	68·3	8	35·6	26	61·0	44·5	42·2	68	124·3	28·3	·42	14	4·6
Wellington	64·0	23	33·0	26*a*	52·7	41·5	41·3	80	109·0	29·0	6·45	19	4·4
Auckland	63·0	4	39·0	12	57·4	46·0	46·5	83	115·0	29·0	3·03	19	6·5
Jamaica, Kingston	...	...	...	...	...	...	...	...	...	...	...	...	...
Barbados	85·0	7, 10	70·0	19	84·0	73·0	69·5	76	145·0	...	3·78	20	5·0
Toronto	81·1	16	41·3	19	71·1	51·1	52·2	73	...	32·2	1·92	12	5·3
New Brunswick, Fredericton	82·7	17	41·0	28	72·3	49·1	51·7	65	...	...	1·87	8	5·0
Manitoba, Winnipeg	91·0	30	31·3	7	77·1	46·0	51·2	67	...	...	1·21	12	4·5
British Columbia, Victoria	77·0	2	40·0	12	66·5	47·5	...	...	...	...	1·00	6	...

a And 27.

REMARKS, JUNE, 1886.

MALTA.—Mean temp. 70°·2; mean hourly velocity of wind 10·0 miles; velocity reached 37 miles per hour on 9th. On 10th, at noon, and again at 4.20 p.m., a large undulation entered the bay, the level of the water changing about five feet in about three minutes. Pressure at the time about the average, and wind S.W.; velocity 20 miles per hour. The aspect of the bay and coast is N.E. J. SCOLES.

Mauritius.—Rainfall 1·40 in. below the average; mean temp. about the average; mean hourly velocity of wind 13 miles; extremes 27·4 miles on 13th and 2·2 miles on 7th; prevailing direction E.S.E. C. MELDRUM, F.R.S.

Melbourne.—Rainfall 1·17 in., mean temp. of air 0°·3, and of dew point 1°·0, mean humidity 2, and mean amount of cloud 0·2 below average; pressure ·249 in. above average. Prevailing winds N. and S.W., strong on 4 days; heavy dew on 10 days, hoar frost on 5, fog on 2, squally on 2. R. L. J. ELLERY, F.R.S.

Adelaide.—Remarkably dry; rainfall more than two inches below the average of 29 years. Pressure very high, mean (30·361 in.) nearly a quarter of an inch above the average. Mean temp. slightly below average, but diurnal range large. The rainfall of the first six months was only 4·07 in., or 6·03 in. below the average; the least rainfall for the first half of the year ever recorded here. C. TODD.

Wellington.—On the whole a showery, unpleasant month; frequent R with S and H, especially towards the latter part. Prevailing winds S.E., S.W., and N.W., strong on six days. Rainfall 1·24 in. above, mean temp. 1°·9, and pressure slightly, below average. T on 9th; slight earthquake on 29th. R. B. GORE.

Auckland.—A cool, showery month, with little wind. Rainfall considerably below, pressure slightly above, and mean temp. about, the average. T. F. CHEESEMAN.

BARBADOS.—Mean temp. (77°·6) 1° above the average; rainfall much below the average; mean hourly velocity of wind 13·5 miles; extremes 18 miles and 10·9 miles per hour. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, DECEMBER, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	5·02	XI.	Castle Malgwyn	...
,,	Margate, Birchington...	4·76	,,	Rhayader, Nantgwillt..	13·13
,,	Littlehampton	5·28	,,	Carno, Tybrith	9·13
,,	Hailsham	5·44	,,	Corwen, Rhug	6·32
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	7·65
,,	Alton, Ashdell.....	5·96	,,	I. of Man, Douglas	7·28
III.	Winslow, Addington ...	5·53	XII.	Stoneykirk, Ardwell Ho.	4·32
,,	Oxford, Magdalen Col...	5·01	,,	Melrose, Abbey Gate ...	3·48
,,	Northampton	3·89	XIII.	N. Esk Res. [Penicuick]	2·60
,,	Cambridge, Beech Ho...	3·26	XIV.	Ballantrae, Glendrishaig	5·62
,,	Wisbech, Bank House..	3·51	,,	Glasgow, Queen's Park.	3·23
IV.	Southend	...	XV.	Islay, Gruinart School..	6·32
,,	Harlow, Sheering	3·09	XVI.	St. Andrews, Pilmour Cot	2·84
,,	Rendlesham Hall	4·16	,,	Balquhidder, Stronvar..	5·96
,,	Diss	3·38	,,	Dunkeld, Inver Braan..	2·61
,,	Swaffham	4·02	,,	Dalnaspidal H.R.S. ...	4·48
V.	Salisbury, Alderbury...	6·15	XVII.	Keith H.R.S.	3·23
,,	Warminster	6·07	,,	Forres H.R.S.	2·17
,,	Calne, Compton Bassett	6·00	XVIII.	Strome Ferry H.R.S....	8·27
,,	Ashburton, Holne Vic..	10·71	,,	Tain, Springfield.....	2·02
,,	Holsworthy, Clawton...	5·83	,,	Loch Shiel, Glenaladale	11·26
,,	Hatherleigh, Winsford.	4·37	,,	S. Uist. Ardkenneth ...	5·98
,,	Lynmouth, Glenthorne.	6·24	,,	Invergarry	7·77
,,	Probus, Lamellyn	7·08	XIX.	Lairg H.R.S.	...
,,	Wincanton, Stowell Rec.	6·76	,,	Forsinard H.R.S.	5·51
,,	Taunton, Lydeard Ho...	6·38	,,	Watten H.R.S.	3·52
,,	Wells, Westbury.....	4·96	XX.	Dunmanway, Coolkelure	8·25
VI.	Bristol, Clifton	5·18	,,	Fermoy, Gas Works ...	3·56
,,	Ross	4·43	,,	Tralee, Castlemorris ...	6·82
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	5·31
,,	Cheadle, The Heath Ho.	3·97	,,	Newcastle West	...
,,	Worcester, Diglis Lock	4·11	,,	Miltown Malbay.....	5·72
,,	Coventry, Coundon	3·52	XXI.	Gorey, Courtown House	3·82
VII.	Melton, Coston	3·85	,,	Navan, Balrath	3·00
,,	Ketton Hall [Stamford]	4·18	,,	Mullingar, Belvedere ...	4·21
,,	Horncastle, Bucknall ...	3·45	,,	Athlone, Twyford	3·46
,,	Mansfield, St. John's St.	4·17	XXII.	Galway, Queen's Coll...	4·28
VIII.	Macclesfield, The Park.	4·84	,,	Clifden, Kylemore	6·85
,,	Walton-on-the-Hill.....	4·58	,,	Crossmolina, Enniscoe..	9·04
,,	Lancaster, South Road.	5·29	,,	Collooney, Markree Obs.	6·68
,,	Broughton-in-Furness ..	7·36	,,	Carrick-on-Shannon ...	5·63
IX.	Wakefield, Stanley Vic.	3·25	XXIII.	Rockcorry.....	5·39
,,	Ripon, Mickley	3·97	,,	Warrenpoint	4·40
,,	Scarborough.....	4·07	,,	Newtownards	3·71
,,	East Layton [Darlington]	3·32	,,	Belfast, New Barnsley..	6·73
,,	Middleton, Mickleton ..	4·29	,,	Cushendun	7·25
X.	Haltwhistle, Unthank..	5·37	,,	Bushmills	4·82
,,	Shap, Copy Hill	8·02	,,	Stewartstown	4·11
XI.	Llanfrechfa Grange	6·04	,,	Buncrana	5·87
,,	Llandovery	7·91			

DECEMBER, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg	Min. Date.	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	4·34	+ 2·17	1·82	26	18	53·9	6	19·7	20	18	26
II.		Maidstone (Hunton Court)...	4·92	+ 2·52	2·12	26	20	...	...	...	...	...	...
,,		Strathfield Turgiss	4·14	+ 2·12	1·18	26	15	54·0	7	16·7	31	19	27
III.		Hitchin	4·20	+ 2·15	1·27	26	18	53·0	6	15·0	31	19	...
,,		Banbury	4·89	+ 2·74	1·00	26	23	51·0	6	18·0	20	19	...
IV.		Bury St. Edmunds (Culford)	3·16	+ 1·01	·81	26	17	53·0	6	15·0	2*a*	23	...
,,		Norwich (Cossey)	...	...	...	...	...	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	6·24	...	1·82	26	21	53·0	6	24·0	20*b*	13	...
,,		Barnstaple	7·16	+ 3·40	1·36	26	22	54·0	6	17·0	21	...	...
,,		Bodmin	6·36	+ ·91	1·26	26	27	52·0	6	20·0	21	8	19
VI.		Stroud (Upfield)	3·90	+ 1·47	1·36	26	20	48·0	5, 7	19·0	31	22	...
,,		ChurchStretton(Woolstaston)	4·51	+ 1·72	·70	8	21	51·0	5, 6	23·0	18	18	29
,,		Tenbury (Orleton)	3·57	+ 1·06	·78	26	21	56·0	6	15·8	21	19	23
VII.		Leicester	3·67	...	·89	14	19	53·5	5	18·5	21	15	30
,,		Boston	3·11	+ 1·04	·91	14	15	52·0	6	18·0	20	19	...
,,		Hesley Hall [Tickhill].....	3·77	...	·80	14	17	52·0	5	18·0	21	18	...
VIII.		Manchester (Ardwick).....	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ...	3·52	+ 1·31	·60	13	13	...	...	...	...	...	...
,,		Skipton (Arncliffe)	9·06	+ 3·78	1·60	11	21	49·0	5	14·0	20	15	...
,,		Hull (Beverley Road)	3·50	+ 1·03	1·12	14	22	50·0	5	20·0	18	19	28
X.		North Shields	3·36	+ ·27	1·03	11	15	54·5	5	15·5	21	24	26
,,		Borrowdale (Seathwaite).....	18·62	+ 4·89	2·48	3	22	44·9	10	17·5	18	5	...
XI.	WALES.	Cardiff (Ely).....	6·60	+ 2·69	·95	26	21	...	...	...	...	...	...
,,		Haverfordwest	6·56	+ 1·43	·88	7	21	52·0	5, 6	11·0	20	16	26
,,		Plinlimmon (Cwmsymlog) ...	6·30	...	·81	6	20	...	...	...	...	...	...
,,		Llandudno.....	4·04	+ 1·19	·76	6	25	...	...	25·5	21	8	...
XII.	SCOTLAND.	Cargen [Dumfries]	5·10	+ ·57	·82	21	18	52·0	6	7·2	21	17	...
,,		Jedburgh (Sunnyside).....	3·29	+ ·84	·69	23	17	52·0	5	5·0	21	24	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	6·19	+ ·01	·74	7	20	...	...	...	...	...	...
,,		Oban (Craigvarren)	5·36	...	·53	21	22	51·3	5	22·3	20	15	...
,,		Mull (Quinish).....	8·53	...	1·52	21	20	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·20	+ ·54	·80	23	15	...	...	...	...	...	...
,,		Arbroath	2·37	— ·53	·80	22	16	46·0	6	19·0	21	23	...
XVII.		Braemar	1·77	— 1·66	·36	5	17	45·8	5	0·0	27	27	31
,,		Aberdeen	4·23	...	·89	22	20	43·0	5, 6	12·0	19*c*	25	...
XVIII		Lochbroom	8·86	...	1·44	8	28	...	...	...	...	...	...
,,		Culloden	2·56	+ ·72	...	...	...	49·0	5	20·0	3*d*	20	31
XIX.		Dunrobin	...	...	...	...	...	...	...	...	...	...	...
,,		Kirkwall (Swanbister)..... ..	6·14	...	·89	8	29	47·1	5	21·1	20	...	19
XX.	IRELAND.	Cork (Blackrock)	4·38	— ·38	·78	7	19	56·0	5	19·0	20	14	...
,,		Dromore Castle	7·50	...	1·22	21	20	58·0	1	23·0	20	...	...
,,		Waterford (Brook Lodge) ...	5·60	...	·94	14	18	55·0	5	17·0	21	16	...
,,		Killaloe	5·66	...	1·42	21	22	51·0	13	24·0	19*e*	17	...
XXI.		Carlow (Browne's Hill)	3·35	— ·16	·68	8	19	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	3·35	+ ·77	·73	14	21	53·2	6	22·0	21	12	29
XXII.		Ballinasloe	4·51	+ 1·03	·78	21	22	49·0	9	15·0	20	24	...
XXIII		Waringstown	5·61	+ 2·65	1·70	8	22	53·0	5	10·0	19	24	28
,,		Londonderry (Creggan Res.).	6·27	...	·52	18	29	...	...	...	...	...	...
,,		Omagh (Edenfel)	5·08	+ 1·68	·52	18	25	53·0	5	7·0	19*g*	24	28

a And 21, 31. *b* And 21. *c* And 20. *d* And 19, 20, 27. *e* And 20. *f* And 21. *g* And 20.

+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON DECEMBER, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—December was exceptionally cold and stormy. In the early part of the month the temp. was low, and a very violent gale and TS occurred on the 8th; heavy R marked the second week; in the third week great cold prevailed, with another heavy gale and S storm on the 26th.

HITCHEN.—The heaviest fall of S ever experienced here occurred on the 26th, preceded and followed by much L; it nearly all fell between 5.30 p.m. and 10.30 p.m., and yielded 1·27 in.

BANBURY.—Mean temp. 34°·5; H on 1st and 8th; S on 8th, 9th, 22nd and 26th; high wind on six days, fog on two.

CULFORD.—Very changeable, with dense fogs, heavy S storms and high winds.

LANGTON HERRING.—A month of very unsettled weather. Rainfall the heaviest in any month since 1877, with the exception of October, 1882. Mean temp. at 9 a.m. 2°·0 below the average of 14 years. The changes of temp. were sudden and great; at 9 a.m. on 21st it was 24°, at 9 a.m. on 22nd, 44°. There was a severe storm on the 8th and 9th, when pressure was very low for many hours. Another storm, with heavy S, occurred on the night of the 26th, when several trees were uprooted or snapped in two.

BODMIN.—Mean temp. 38°·2. On the 28th a severe TS occurred at 8.15 p.m.; a colt was killed by L at Trescowe, four miles from here, and another very much injured. S on 17th, 18th and 19th, and a little S, which melted directly, on 26th.

STROUD.—N.W. gale on 6th; S.W. by W. gale at night on 7th; severe S.W. gale with T, L and H on 8th; L on 12th and 18th; S about four inches deep on 26th, with more on the hills; fog on four days.

WOOLSTASTON.—The early part of the month was very stormy. There was a strong gale on the 8th and 9th, with L and H, and a remarkable and long-continued barometric depression, the lowest reading ever observed occurring about 9 p.m. on the 8th. The remainder of the month was cold, with sharp frost. S on 1st and 26th. Mean temp. 35°·3.

ORLETON.—The weather was very changeable throughout, with rainfall much above the average, and few dry days. The frost was severe on the first five days, and on the 6th temp. rose to 56°; this was followed by the greatest barometric depression that I have ever registered in 60 years. About 7 p.m. on the 8th the bar. stood at 27·83 in. (uncorrected), which was nearly a tenth of an inch lower than on the 13th January, 1843. S on the hills and floods in the river followed; frost then set in again, and continued severe at times till the end of the month. On the 26th, after frost, small R set in at 8.30 a.m., changing to S about 1.30 p.m, and covering the ground three inches deep before midnight. Severe frost followed, and on the 31st there was a dense fog. L on 18th.

HULL.—A cold month, with ground frost nearly every night; pressure exceptionally low on the 8th.

WALES.

HAVERFORDWEST.—One of the coldest, wettest, and most stormy Decembers in my record of 37 years. The damage done to forest trees during the great storm of the 7th and 8th perhaps exceeds anything in living memory; the pressure was the lowest I ever recorded in this locality. Severe frost prevailed from 15th to 21st, when a sudden and complete thaw set in, which by the sudden melting of the S, caused one of the highest floods remembered. Mean temp. 35°·5. H, R and sleet on 6th. S on five days.

LLANDUDNO.—A month memorable for its storms. A gale of unprecedented

severity from W.S.W. to W. swept over the country during the night of the 7th and the following day; this was preceded and accompanied by frequent heavy showers of R, and though no S fell here, the distant mountains were capped with it. Showers of H and S had fallen on 1st, 2nd, and 3rd, coating the mountains for the first time this winter. The gale was equal to anything of the kind I have ever experienced at Llandudno, and in the whole course of my life I never saw the pressure fall so low and so rapidly. The heavy S storm which visited the metropolis and the south of England on the night of the 26th, we happily escaped at Llandudno; also the severe cold which prevailed about the end of the month in many parts of both England and Scotland. There were only 8 frosty nights. The mean temp. (40°·4) was 2°·1 below the average, and the monthly range (27°·5) and daily range (8°·3) were both within a fraction of the average. There was a marked deficiency of sunshine.

SCOTLAND.

CARGEN.—The month was remarkable for sudden and great fluctuations of pressure and temperature. The lowest pressure ever recorded here was observed on the 8th, notwithstanding which the weather was in no way remarkable, the force of the wind not being more than 3 (scale 0 to 10), and the rainfall by no means excessive. A hard frost set in on the 17th, the temp. on the night of the 20th falling to 7°·2; at 9 a.m. on the 21st, the thermometer registered 11°, and at 9 p.m. it had risen to 41°. Mean temp. (34°·2), 4°·6 below the average. Gale on 1st; S showers on 1st and 7th; S (three inches deep) on 19th.

JEDBURGH.—Temperature low throughout. The S fall was much greater here than in the adjoining counties. After the 20th the fall was slight.

OBAN.—The coldest December since 1880, with a considerable preponderance of N. wind; consequently the air was unusually dry, and the heavy gales mostly travelled southward of this station. On the 8th, pressure was exceedingly low, with a heavy N. gale and L. S on six days.

BRAEMAR.—A very cold, unsettled month. Pressure on the 8th, the lowest recorded in this district.

ABERDEEN.—While the number of rainy days was not excessive, the rainfall was about an inch above the average, owing to five separate heavy falls of R and S. Temp. very low. Pressure on the 8th, the lowest recorded here, with the exception of the night of 26th January, 1884.

LOCHBROOM.—We have had no such severe storms, hard frost, or deep S in this district since 1879, and not previously since 1849. The month, on the whole, was one continued storm of S, H, R, sleet, frost, and L. Great distress prevailed among flocks depending on hill pasture and all around here.

CULLODEN.—A severe month, frost prevailing and S covering the ground throughout. Farm work at a standstill.

SWANBISTER.—Windy and wet; frosty at the close; with only 28 hours of sunshine, nearly half of which occurred during the last week. S, sleet, and H were frequent.

IRELAND.

BLACKROCK.—Mostly dull, damp, and misty, with a strong gale on 7th and 8th. Mean temp. 38°·9.

KILLALOE.—A great storm occurred on 8th, with very low pressure, the period of greatest violence being from 10 a.m. to 1 p.m. There were some sharp frosts, and T and L were frequent.

DUBLIN.—A cold month, the weather being especially unsettled and changeable. Pressure exceptionally low on 8th. Mean temp. 3°·4 below the average. Solar halos on 2nd, 13th, and 25th; H on 8th, 16th, and 20th. S or sleet on 7 days, fog on 9, high wind on 16, gales on 4 days. Mean humidity 88, mean amount of cloud 5·3; prevailing winds W. and W.N.W.

WARINGSTOWN.—The lowest pressure ever recorded here occurred on the 8th.

EDENFEL.. The most severe and inclement December for many years, with

remarkable barometric and thermometric depressions, and S and E much above the average in frequency and amount. On the 8th we were here in the very centre of a barometric depression—unprecedented, so far as I can ascertain, and lower than even that of January 26th, 1884. The lowest point was touched at 2 p.m., when a dead calm prevailed, nor was there any atmospheric disturbance till 1 a.m. next morning. On the 20th, after a snowfall of 13 inches in the previous two days, a remarkable cold wave passed over this district. E was falling at 6 a.m., within two hours of which the shade temp. had fallen to 7°, and at 5 the same evening 1° was registered on the surface of the S, after which the cold wave gradually passed away; 17° being reached at 10 p.m., and 35° at 9 a.m. next morning.

THE RECENT SUMMER AND THE WEATHER CYCLISTS.

To the Editor of the Meteorological Magazine.

SIR,—I am sorry that Mr. Brumham should have felt aggrieved by my letter which you were good enough to insert in your Magazine for December.

Mr. Brumham seems to forget that the freedom of thought and utterance for which he pleads has two sides to it, and that if it involves, as I fully admit that it does, the right to publish to the world any speculations, however extravagant or unfounded they may be, it involves also the right to criticise such speculations, and to bring them to the test of facts. And this is all that I did in reference to his predictions in your Magazine for last June.

Mr. Brumham predicted that the summer would be "a warm one of long duration," and that it would "give us some periods of excessive heat." I showed by statistics compiled from about 80 stations reporting to the Meteorological Office that the summer had, on the whole, been a cool one; that, inasmuch as, with the exception of about a week at the beginning of July, there had been no warm weather up to the middle of August, it could not be said to have been of "long duration," and that there had been no periods of excessive heat.

What has Mr. Brumham to say in answer to all this? His letter, which purports to be a reply to my criticisms, consists almost entirely of a number of wholly irrelevant statements as to the general similarity of the weather of last year to that of the year 1869, a point upon which I had not expressed any opinion. Here, for instance, are a few examples:—"March was remarkably cold to the 19th." "In March and April rain fell on 27 days, to the amount of 2·4 inches." "May was remarkably wet." Total rainfall in May and June 4·7 in.," &c., &c., &c. What, in the name of common sense, have these statements to do with the question as to which Mr. Brumham and myself are at issue?—"Was the late summer a hot summer of long duration?" The only facts at all relevant to the question at issue which Mr. Brumham adduces are certain high maxima registered by the sheltered thermometer at Greenwich, and these are quoted under a misapprehension. For Mr. Brumham does not seem to be aware that, owing to the defective exposure of the

instrument, the readings of the shaded thermometers at Greenwich in bright summer weather are sometimes several degrees in excess of the true reading. I am sure Mr. Brumham will thank me for quoting, for his information on this point, some remarks from the recently published "Report on the Temperature and the Rainfall of the Croydon District, 1881–85," by Mr. Storks Eaton:—"At the Royal Observatory, Greenwich, another important and more potent factor comes in. There it seems that the recorded maximum temperatures are vitiated by the character of the thermometer stand. . . . . In fact, in bright weather in the height of summer, the maximum temperature, as recorded at the Royal Observatory, sometimes exceeds by several degrees that observed anywhere else in the neighbourhood." So that when I mentioned 87° as the highest authentic shade-temperature recorded last summer, I was probably not far from the truth. [The *very* apocryphal reading of 95° said to have been registered at Boston may safely be treated as a "*quantité négligeable.*"] The only really exceptional heat, for the season, experienced during the past year was in the first fortnight in October. Mr. Brumham naturally makes the most of this, as a drowning man will catch at a straw. But even granting the widest possible latitude that can be claimed for the term "summer," I must decline to admit that October can properly be included amongst the summer months.

In the concluding paragraph of his letter Mr. Brumham places me before your readers in the light of a Grand Inquisitor, who, if he could, would "torture him into confessing, on his knees, that the weather does not move in cycles." I am sorry to deprive him of the luxury of posing as a nineteenth-century Galileo, but he must allow me to assure him that, so far am I from wishing to interfere with his investigations and his claim to assume the mantle of a weather prophet, that the more of such predictions we have from him, the better shall I be pleased, being convinced as I am that the more such speculations are ventilated, the sooner will their futility be demonstrated, and the nearer we shall be to the time when the time and labour now wasted in illusory speculations will be devoted to researches from which we may hope for solid and durable fruit.

G. T. RYVES, F.R.Met.Soc.

Tean Vicarage, Jan. 7th, 1887.

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